RADIO NEWS

APRIL
1947
35c

SALES CHAMPIONS

The Radio of TO-MORROW . . . TO-DAY!

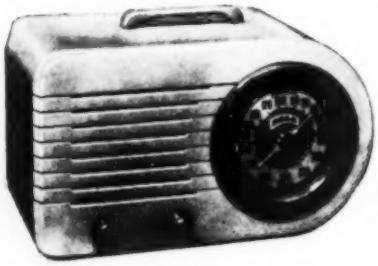
by FADA

MODEL P82

Tri-power portable Superheterodyne with Hi-Gain tuned RF stage in rich two-tone simulated leather covered wood cabinet. 5 tubes plus rectifier tube.

MODEL 602

New Superheterodyne AC Table Model Radio Phonograph Combination with Automatic Record Changer in a Cabinet of Beautiful Mahogany Veneers.

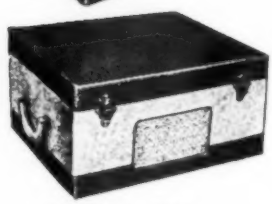


MODEL 1000

AC-DC Superheterodyne in beautiful gem-like "Fada-Lucent" cabinets. Five Tubes plus Rectifier Tube.

FADA *Sensive-Tone*

FADA 5-tubes—plus-rectifier-tube models are equipped with the new FADA "Sensive-Tone" ...assuring greater sensitivity and clearer reception.



MODEL 633

New Portable Electric Phonograph in smart DeLuxe two-tone luggage case. Plays 10 or 12 inch records with the lid closed. Incorporates advanced engineering developments.

YOU CAN ALWAYS DEPEND ON

FADA

Radio

Famous Since Broadcasting Began!

FADA RADIO AND ELECTRIC COMPANY, INC., LONG ISLAND CITY, N. Y.

Be Your Own Boss

I WILL SHOW YOU HOW TO START A RADIO SERVICE BUSINESS *Full Time or Spare Time* WITHOUT CAPITAL

J. E. SMITH, President
National Radio Institute
Our 33rd Year of Training Men for Success in Radio

SAMPLE LESSON FREE

Do you want a good-pay job in the fast-growing Radio Industry—or your own money-making Radio Shop? My train-at-home method has helped hundreds of men with *no previous experience* become qualified Radio Technicians. Mail the Coupon and you'll get a Sample Lesson and my 64-page book, "How to Be a Success in RADIO—Television, Electronics," both FREE. See how you get practical Radio experience at home, building, testing Radio circuits with BIG KITS OF PARTS I send!

VETERANS

You can get this training in your own home under G.I. Bill. Mail coupon for full details.

Many Beginners Soon Make Extra Money in Spare Time While Learning

The day you enroll I start sending EXTRA MONEY JOB SHEETS. You LEARN Radio principles from my easy-to-understand, illustrated lessons—PRACTICE what you learn with parts I send—USE your knowledge to make EXTRA money fixing neighbors' Radios in spare time while still learning! From here it's a short step to your own *full-time* Radio Shop or a good Radio job!

Future for Trained Men Is Bright in Radio, Television, Electronics

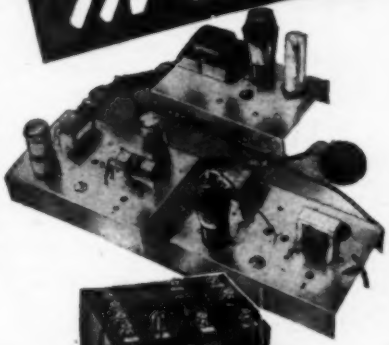
It's probably easier to get started in Radio now than ever before, because the Radio Repair Business is booming. Trained Radio Technicians also find profitable opportunities in Police, Aviation, Marine Radio, Broadcasting, Radio Manufacturing, Public Address work. Think of even *greater* opportunities as Television, FM, and many new, war-developed Electronic devices become available to the public! Get the facts on all these opportunities. Send for FREE books now!

Find Out What NRI Can Do for You

Mail Coupon for Sample Lesson, "Getting Acquainted with Receiver Servicing," and my FREE 64-page book. It's packed with facts about Radio's opportunities for you. Read the details about my Course. Read letters from men I trained, telling what they are doing, earning. See how quickly, easily you can get started. No obligation! Just MAIL COUPON NOW in an envelope or paste it on a penny postal. **J. E. Smith, President, Dept. 7DR, National Radio Institute, *Pioneer Home Study Radio School*, Washington 9, D. C.**

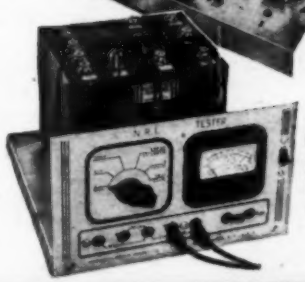
You build this A. M. SIGNAL GENERATOR that gives you valuable experience. Provides amplitude-modulated signals for test and experiment purposes.

LEARN RADIO BY PRACTICING IN SPARE TIME



With Big Kits of Radio Parts I Send You

You build this SUPERHETERODYNE CIRCUIT that brings in local and distant stations. You get practical experience putting this set through fascinating tests!



You build this MEASURING INSTRUMENT yourself early in the course—use it for practical Radio work on neighborhood Radios to pick up EXTRA spare time money!

I TRAINED THESE MEN

Makes $60 a Week Plus Bonus

"I am Radio Serviceman for Hardaway Appliance Co. Am now getting $60 a week, plus bonus and overtime. I have often wondered just what I would be doing now if I had not taken your course in Radio." — W. A. ANGEL, Blythesville, Ark.

Knew Nothing About Radio

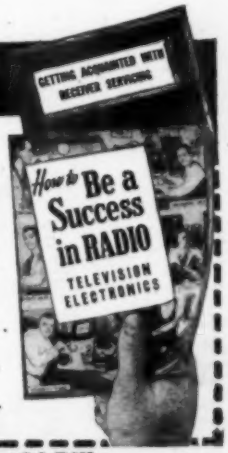
"I knew nothing about Radio when I enrolled. At present I am doing spare time work. I have more than paid for my Course and I have about $200 worth of equipment which has paid for itself." — RAYMOND HOLTCAMP, Vandalia, Ill.

Makes $3,640 a Year with Civil Aeronautics Administration

"I am now attached to the Airway Communications Station, Civil Aeronautics Administration, in capacity of Chief Aircraft Communicator. My salary is $3,640 per year." — LESTER W. PEARSE, Elke, Nevada.

MY COURSE INCLUDES TRAINING IN **Television • Electronics**

GET BOTH 64 PAGE BOOK SAMPLE LESSON FREE



J. E. SMITH, President, Dept. 7DR
National Radio Institute, Washington 9, D. C.

Mail me FREE, without obligation, Sample Lesson and 64-page book about how to win success in Radio and Television—Electronics. (No salesman will call. Please write plainly.)

Age.....

Name.....

Address.....

City.....State.....

(Please include Post Office Zone Number)

Approved for Training under GI Bill

THE COVER: Final inspection of tube checkers at Sylvania Electric Products Inc. plant. Check includes conditions similar to those encountered in a radio serviceman's shop.

RADIO NEWS

First in radio-electronics

Average Paid Circulation over 130,000

Reg. U. S. Pat. Off.

APRIL, 1947

FOR THE SERVICEMAN-DEALER

FOR THE AMATEUR

OF GENERAL INTEREST

DEPARTMENTS

185 North Wabash Ave., Chicago 1, Ill.
VOLUME 37 • NUMBER 4

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Snap-on

Vacuum Grip Pliers

REG. U.S. PAT. OFF.

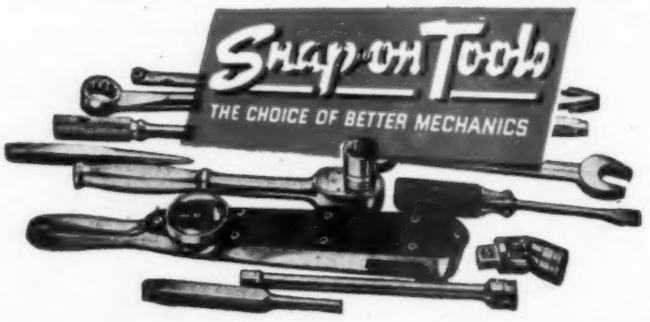
A complete line . . . engineered for performance

Pliers are basic tools in an extremely wide and varied range of operations. The *right pliers for the job* can make a tremendous difference in speed and workmanship. The Snap-on pliers illustrated are typical of the many types of Vacuum Grip pliers . . . each type *job-engineered* for peak performance on the work for which it is designed.

Snap-on builds Vacuum Grip pliers in a modern plant devoted exclusively to the production of the finest, most efficient pliers that can be produced. Vacuum Grip pliers are hammer forged from special high carbon chrome-silico-manganese alloy tool steel, hardened and tempered through and through. Light in weight, perfectly balanced. Smooth, easy riding joints, sharp, deeply milled teeth. Hand filed, perfectly aligned cutters. Spring-tempered, "Vacuum Grip", non-slip handles.

A famed name in Snap-on's complete line of more than 3,000 tools for production and service, Vacuum Grip pliers are available everywhere through Snap-on's nation-wide direct-to-user tool service.

SNAP-ON TOOLS CORPORATION
8120-D 28th AVENUE KENOSHA, WISCONSIN

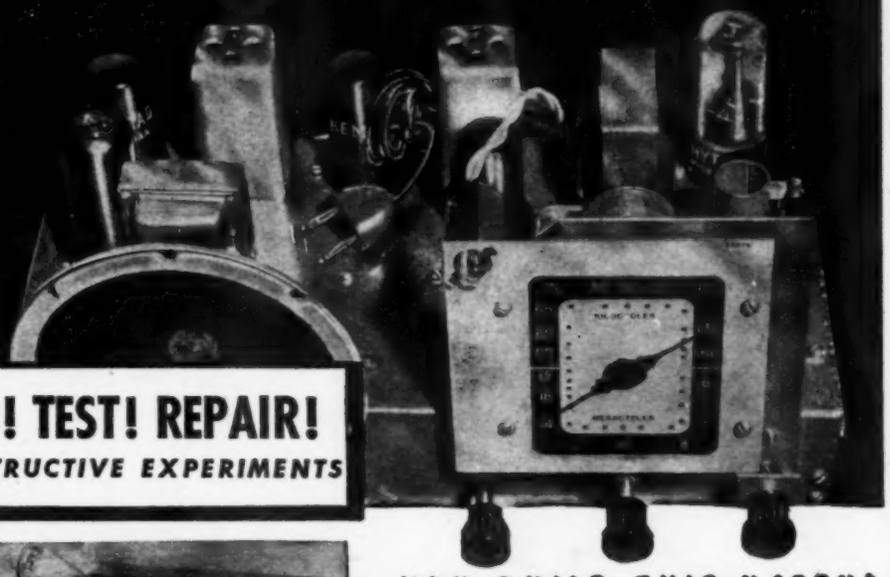


NOW! An Amazing Opportunity to LEARN RADIO AT HOME

I SEND YOU 8 BIG KITS OF RADIO PARTS

Including a COMPLETE 6 TUBE SUPER-HETERODYNE RECEIVER

I TRAIN YOU RIGHT by PUTTING YOU TO WORK with REAL PROFESSIONAL EQUIPMENT!



LEARN HOW TO BUILD CIRCUITS! TEST! REPAIR!
YOU DO OVER 175 INSTRUCTIVE EXPERIMENTS

HERE'S THE EASIEST, MOST PRACTICAL WAY OF ALL TO PREPARE FOR GOOD PAY in RADIO ELECTRONICS and TELEVISION!

I train your mind by putting you to work with your hands on a big 6-Tube Superheterodyne Receiver. And, believe me, when you get busy with real Radio Parts — 8 big Kits of them — you really LEARN Radio and learn it RIGHT! You get the practical stuff you need to be useful in Radio, and that's what it takes to make money. You don't have to worry about what to do with these 8 Kits of Parts. Step by step, I show you how to build circuits, test, experiment, trouble-shoot. And you don't need any previous experience. The Sprayberry Course starts right at the beginning of Radio! You can't get lost! Simplified lessons, coupled with real "Shop" practice, makes every subject plain and easy to understand and remember. Soon after you begin Sprayberry Training, I'll send you my sensational BUSINESS BUILDERS.

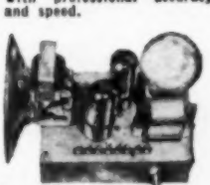
A BUSINESS OF YOUR OWN . . . OR A GOOD RADIO JOB

You'll find out how to get and do neighborhood Radio repair jobs for nice profits and rich experience while learning. This sort of work can easily pave the way for a Radio Service business of your own. But with Sprayberry Training, you're not limited. You can swing into any one of the swiftly expanding branches of Radio-Electronics INCLUDING Radio, Television, FM, Radar, Industrial Electronics. Be wise! Decide now to become a fully qualified RADIO - ELECTRONICIAN. Get full details about my Training at once! Mail coupon below for my 2 big FREE Books.

YOU BUILD THIS USEFUL TEST EQUIPMENT!

I give you a fine, moving-coil type Meter instrument on Jewel Bearings — with parts for a complete Analyzer Circuit Continuity Tester. You learn how to check and correct Receiver defects with professional accuracy and speed.

Soldering, wiring, connecting Radio parts . . . building circuits — you can't beat this method of learning. When you construct this Rectifier and Filter, Resistor and Condenser Tester, etc., you get a really practical slant on Radio.



You'll get valuable experience and practice building this Signal Generator and multi-purpose Tester. Makes a breeze out of fixing Radios and you don't have to spend money on outside, ready-made equipment.

GET THESE VALUABLE FREE BOOKS

"How to Read Radio Diagrams and Symbols"

Here's a valuable and wonderfully complete new book which explains in simple English how to read and understand any Radio Set Diagram. Includes translation of all Radio symbols. Send for this volume at once. It's free! Along with it, I will send you another Big Free book describing in detail my Radio-Electronic Training.

RUSH COUPON!

SPRAYBERRY ACADEMY OF RADIO
F. L. Sprayberry, President, Room 2547, Pueblo, Colorado

Please rush my FREE copies of "How to MAKE MONEY in RADIO, ELECTRONICS and TELEVISION," and "HOW to READ RADIO DIAGRAMS and SYMBOLS."

Name ..... Age .....

Address .....

City ..... State .....

(Mail in envelope or paste on penny postcard)

For the RECORD

BY THE EDITOR

IT IS axiomatic that we live in a changing world—a fast changing world. The speeding tempo of our industrial developments and the productive capacities of our scientists and engineers are constantly and repeatedly translated into the format of our daily work and living. Today there is no greater stimulus to this fast changing pattern of work than that provided by the radio-electronic industry.

What is the picture in 1947? FM is well on the road toward becoming a national reality and public servant; television is here in spite of the fact that the battle of color vs. black-and-white still rages; wire and tape recording and reproduction is tapping on the door; facsimile is ready to burst its bonds and add a new sparkle of lively interest to our daily lives; short range, low power u.h.f. broadcasting bows in auspiciously to release United Nations delegates from the chains of their desks and headphones; and radio circuits are "busting out all over," performing a multitude of jobs with ease and precision. The radio-electronic industry is, indeed, dynamic and the future glows with rosy promises.

But, is our thinking 1947, 1950, or 1955? Or is it 1938-1940? Did we come thundering into this postwar world with a host of volcanic products but mentally chained to a prewar concept of the economics of our industry? Are we foolish enough to think that our immense production facilities can reflect the technological advancements of four terrific years of concentrated scientific developments, and yet let our marketing and service patterns fall back into the same old frame on that great day when "things settle down and get back to normal"? If we are, somebody is due for a shock—a whale of a shock.

Right now we are thinking about radio-electronic service. We are thinking about those 700 FM stations that will probably be built during the next three years, of several hundred television broadcasting stations that could possibly spring up in that same period. We are thinking of FM receivers, of television receivers, of facsimile receivers, and dozens of other electronic devices. We are thinking too of Citizens' radio transceivers, of dial-operated car radios, truck radios, taxicab radios, airborne radios, shipborne radios and radar, and we haven't even mentioned AM. This multitude of radio equipment spells radio service *need* and brother, you can spell that NEED in capital letters!

The sale of such equipment can expand only to the degree that such units can be kept in service, whether in the home or in a factory. In particular, the demand for electronic time and money savers must depend on the distribution and availability of standard replacement parts where they can be had on short notice when needed. None of us would own refrigerators in our homes if we could not call for service when needed and obtain a replacement to keep the machine running. We would not own our beautiful console radios and record changers if we could not get replacement tubes, etc., and we certainly would not spend our hard earned dough for a motor car if we could not have it serviced locally when old "Bessie" failed to turn over.

Paste this in your hat. When there is a need for a commodity or a service, the American system has always supplied men who could capably qualify to keep things going. Radio service too, is going to become a *real business* and *radio service establishments will be operated by real businessmen.*

The bottleneck in the orderly education and operation of qualified national service outlets is guided naturally by the segment of the radio industry that most needs it—the receiver manufacturers. Many of them say they don't want "screwdriver" mechanics tinkering with their sets. When anyone pays a couple of hundred dollars for a piece of mechanical or electrical equipment, he is usually pretty cautious in selecting a serviceman when the set is in need of repair.

Any jack-leg mechanic running a two-by-four garage can get, for the asking, the detailed specifications for the finest and most expensive automobile manufactured. He can get the complete data, he can study the stuff from cover to cover and he can dream to his heart's content that he is fully capable of servicing one of them, but there is just one hitch—no owner will let him try unless he is a recognized "factory-trained" mechanic. Is the customer who puts money in an FM or TV receiver apt to think differently about who services his set?

We don't claim that the "jack-leg mechanic" could do a good job, but we do insist that there are plenty of skilled radio servicemen who could make satisfactory and intelligent repairs provided that they were supplied with complete and factual information on the sets and given efficient training to do such jobs locally in their shops.

We have pointed out, in past editorials, the threat to the radio servicing profession if this business of "selective servicing" turns into a phobia with the manufacturers to a point where it might completely distort their thinking. If so, they are drifting into potentially dangerous waters. . . . . O.R.

Order Your Communications Receiver from ALLIED!

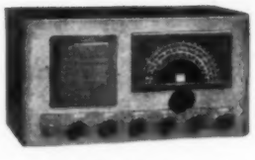
IMMEDIATE DELIVERY

on most models

NATIONAL HRO
NET, *less speaker*, $274.35

RME-45
NET, *with speaker*, $198.70

IMMEDIATE DELIVERY



RME-84
NET, *with speaker*, $98.70

NATIONAL NC-46
NET, *with speaker*, $107.40

Other Communications Equipment

Hallicrafters SX-42	$275.00
Hallicrafters S-38	47.50
Hallicrafters S-40A	89.50
Hallicrafters S-41G	36.75
National NC-2-40D	225.00
Hammerlund SPC-400X	342.00
Hammerlund HQ-129X	173.25
RME VHF-152 Converter	86.60
RME DB-20 Preselector	68.20
Collins 75A-1 Receiver	375.00
Collins 32V-1 Transmitter	475.00
Collins 30K Transmitter	1250.00

Net F. O. B. Chicago. Prices subject to possible change.

Time Payments

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Everything in Radio and Electronics

for Everything in Radio

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BUYING GUIDE for Servicemen, Amateurs, Sound Men, Builders, Experimenters . . . . .

Send today for this newest value-packed ALLIED Catalog—Radio's most complete Buying Guide from Radio's *leading, dependable,* supply house! It's crammed with thousands of radio and electronic supplies of nationally-known preferred brands—all at real money-saving prices. You'll find everything you need in every field of radio—replacement parts, tubes, test equipment, tools, home radios, Amateur receivers and gear, radio builders' and experimenters' kits, Public Address and sound equipment.

HUGE STOCKS—MORE THAN 10,000 ITEMS

Thousands of seasoned radio men depend upon ALLIED. Our tremendous stocks include over 10,000 individual items covering everything in Radio and Electronics—concentrated to serve you best from a single centralized source. We give your orders, large or small, our expert attention and speedy shipment to assure complete satisfaction. Whatever your needs, you'll get them satisfied better, faster, more economically at ALLIED—The World's Largest Radio Supply House.

FREE! Radio's Leading Buying Guide . . .

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Chicago 7, Illinois

☐ Send FREE 1947 ALLIED CATALOG

☐ Enter order for.....

☐ Enclosed $.....☐ Full Payment
☐ Part Payment (Balance C.O.D.)

☐ Send full information on Communications Receivers and Time Payment Plan, without obligation.

Name.....

Address.....

City.....*Zone*.....*State*.....

Be sure you're right

with the HAMMARLUND FS·135·C

FREQUENCY STANDARD

Connect up the FS-135-C in your receiver and you have a first-class frequency meter all set to go. You will have the satisfaction of knowing you are obeying F.C.C. rules and you'll get accurate signals every 100 KC's to mark the band edges or make any other checks you want.

You will find the FS-135-C is a cinch to connect and it's so small it fits in any receiver. The ingenious circuit and a special crystal permit variation of the crystal frequency for zero beating with WWV. Once this adjustment is made you practically have a WWV junior built right in your receiver.

See the FS·135·C at your dealer's

HAMMARLUND

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ESTABLISHED 1910

THE HAMMARLUND MFG. CO., INC., 460 W. 34TH ST., NEW YORK 1, N.Y.

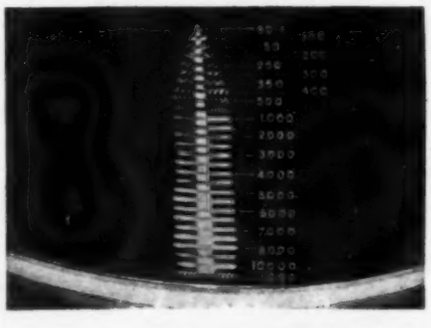
MANUFACTURERS OF PRECISION COMMUNICATIONS EQUIPMENT

NOW! a new standard of performance in cutting heads

THE PRESTO 1-D

▶ The new Presto 1-D Cutting Head offers: *wide range, low distortion, high sensitivity* and *stability through a temperature range of 60°-95° F.* The Presto 1-D Cutting Head is a precision instrument made entirely of precisely machined parts, expertly assembled and carefully calibrated. These factors, plus its sound basic engineering design, produce a cutter unequaled in performance by any other mechanically damped magnetic device.

▶ Note from the light pattern below: The correct location of the cross-over point at 500 cycles, the 6 db per octave slope below this point, and flat response above 500 cycles, which is free from resonant peaks. The range of the cutter is 50-10,000 cycles. The Presto 1-D is damped with "Prestoflex" which is impervious to temperature changes between 60 and 95 degrees Fahrenheit.



Unretouched photograph showing the light pattern. Notice correct location of the cross-over point at 500 cycles.

PRESTO

RECORDING CORPORATION

242 WEST 55TH STREET, NEW YORK 19, N. Y.

Walter P. Downs, Ltd., in Canada

WORLD'S LARGEST MANUFACTURER OF INSTANTANEOUS SOUND RECORDING EQUIPMENT & DISCS

Start Your Own RADIO SERVICE SHOP

Choose one of these 3 GREAT NEW DEALS

$99.50 $179.50 $350.00

Includes TEST EQUIPMENT, TUBES, PARTS, TOOLS

3 complete going-in-business packages. (If necessary they can be changed to suit your needs.)

There never was a better opportunity than now to start a profitable business of your own. No fuss, no worry. Here's everything you need. Details upon request. Write, wire or phone!

Featherweight Miniature TEST INSTRUMENTS

Compact — Accurate — Priced Right!

- Jeweled Meter • Range Selector Switch
- All multipliers bridge tested for 1% accuracy
- Zero adjustment – built in batteries
- Molded bakelite case only 3-15/16" x 2-7/8" x 2"

MODEL 450A
Volt – Ohm – Milliammeter

A fine instrument having a sensitivity of 1000 ohms per volt.
Ranges: Volts DC, 0-5/10/50/500/1000;
Mills DC, 0-1;
Ohms full scale, 0-5000/50,000/500,000;
Ohms center scale, 30/300/3000.

NET complete with batteries **9.75**

MODEL 451A AC-DC
Volt – Ohm – Milliammeter

A dependable instrument of wide utility – sensitivity 1000 ohms per volt.
Ranges: Volts AC, DC, and Output Ranges, 0-10/50/100/500/1000;
Ohms full scale, 500,000.
Ohms center scale, 7200.

NET complete with batteries **13.65**

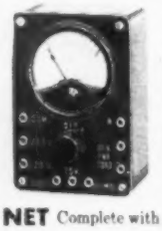
MODEL 451B
Same instrument as above but has 2500 ohms per volt sensitivity.

NET complete with batteries **15.15**

MODEL 452A
Volt – Ohmmeter

A superb instrument – 100 microampere meter gives 10000 ohms per volt sensitivity.
Ranges: Volts DC, 0-10/50/100/500/1000;
Ohms full scale, 0-2000/20,000/200,000/2 Megs;
Ohms center scale, 30/300/3000/30,000.

NET complete with batteries..... **13.65**



MODEL 312
Volt – Ohm – Milliammeter

An economy pocket meter featuring a 2" moving vane meter.
Reads: AC-DC volts, 0-25/50/125/250;
Mills AC-DC, 0-50;
Ohms, 100,000;
mfd. .05-15.
Jacks provide range selection.

NET Complete with cord and plug..... **6.00**

TURNTABLE STAND

$3.91

With each stand we send a stroboscope free.

All steel – adjustable – holds turntable 15" above bench – tilts to any position – speeds work – saves time – prevents damage to parts – pays for itself on first job – you need several at this low price.

PHILCO BEAM OF LIGHT

Selenium cell only, no holder, postpaid... **$1.80**
(Puts new life into Philco Changers)
Sapphire needle only, no mirror, postpaid **$1.20**

SHORT WAVE RECEIVERS

Hallicrafters S-38	**$47.50**
S-40 (Replaces S-20R)	**89.50**
SX-42 (Replaces SX-28A)	**275.00**

SELENIUM RECTIFIERS

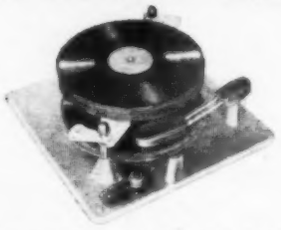
Direct permanent replacement for 117Z6 – 117Z3, etc. No filament – no socket – no trouble.

1 to 5 net **1.08** 6 to 49 net **98c** 50 or more net **90c**

RADIO TUBES

Get our monthly list of available tubes and discounts. Largest available stock of standard brand tubes maintained at all times.

V. M. AUTOMATIC CHANGER



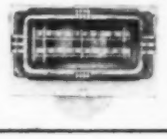
A Two Post Changer with well-made mechanism – plays 10" or 12" records intermixed. Low pressure crystal pickup. Size 14" x 14". Packed two to a factory-sealed carton, factory guaranteed.

SPECIAL EACH **15.95** CARTON OF TWO **29.95**

INTERFERENCE FILTERS

A plug type filter eliminates noise when used in line cord of small motors, vacuum cleaners, etc. A "natural" for increased sales.
net each..... **82c**

SLIDE RULE DIALS



Crowe No. 534 – direct ratio drive – antique bronze escutcheon 2⅜" x 4" – pointer travel 3¾".
NET with pilot lamp bracket... **$1.47**

JEWELLED PILOT LIGHT ASSEMBLIES

- Candelabra screw base for 110 volt lamp.
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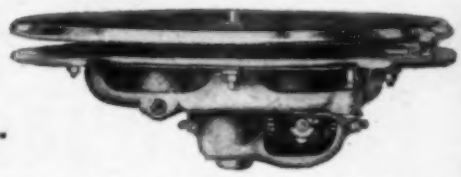

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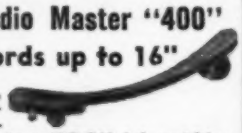

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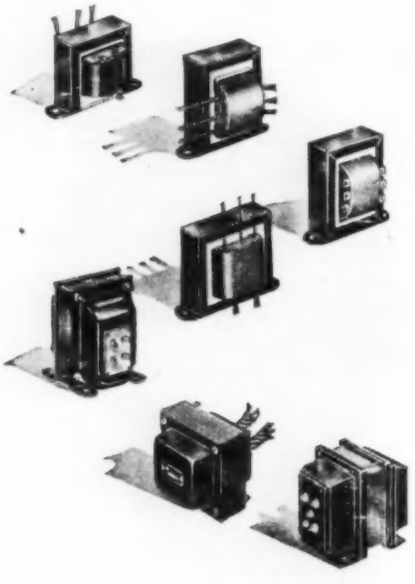

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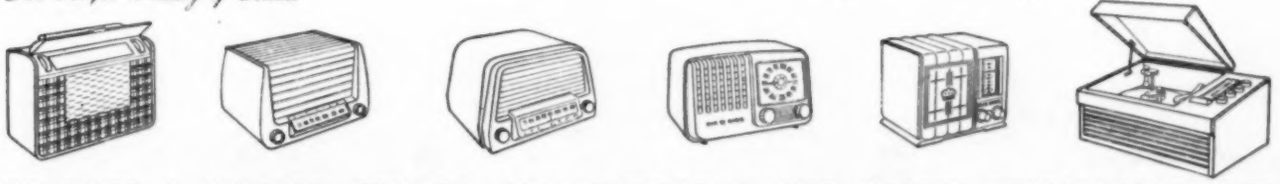

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Spot Radio News

★ *Presenting latest information on the Radio Industry.*

By FRED HAMLIN
Washington Editor, RADIO NEWS

THE DECISION made by the Federal Communications Commission on color television—it had not been handed down as this went to press—is probably one of the toughest FCC ever faced. At least that is the consensus of newspaper and magazine men covering the final three-day hearing in February, and an off-the-record check with FCC members found them in hearty — and haggard — agreement. Everybody also agreed on another thing — the Columbia Broadcasting System and those opposing it on the color question all did a magnificent job of presenting both sides of the case. It was a camera finish any way you figure it. . . . Since we don't know what the Commission finally decided, best we can do at this point is give you all the dope we could accumulate and let you put yourself in the Commission's boots and decide for yourself. After sitting through the hearings, we are so neutral that all we can think of doing is to toss a coin. It was that close.

BASIC ISSUES were these: CBS, supported by the *Bendix Radio Corporation,* sought permission to start work on color television broadcasting to the public over ultra-high frequency channels from 480 to 920 mc., to date allocated for experimental television, but not for commercial television. CBS technicians claimed that they could be serving the public in (about) two years. Opposed to this view were others, representing practically everybody else in the color television field, all of whom have been concentrating on combination color and black-and-white in the present commercial channels—40 to 300 mc. And behind these issues, of course, was a vital economic question: Had the opponents of CBS been caught with their antennas down —was CBS in a position to beat them to the public with color equipment? Or, to put it the other way, had CBS pioneering in the u.h.f. field failed to pay off in practical application?

THIS, IN A NUTSHELL, is the problem facing the FCC. But, actually, it was not that simple, and as the testimony developed, the case began to get as complicated as a short-circuited pinball machine. Ironically, perhaps the best summary of those opposing CBS was made by Adrian Murphy, a Columbia executive. He listed seven objections to the CBS proposals, among them that Columbia's system involved too many mechanical applications and not enough electronics; that its broadcasts were flickery and had to be viewed in a dark room; that broadcasts had to be thrown on too small a receiving screen; that cost factors were too high; that CBS color wasn't as good as present black-and-white, and that the public, speaking generally, isn't much interested in color at this stage anyhow. It goes without saying that Mr. Murphy and other CBS spokesmen denied all these charges in their testimony.

TYPICAL OF THE OPPOSING ARGUMENTS to CBS were those voiced by Dr. Allen B. DuMont of the laboratories of that name at Passaic, New Jersey. Color, he argued, "should be integrated with existing systems, so that previous developments in the art can be used to the fullest and obsolescence of the public investment minimized." No color television was ready for the public at this time, he said. In the words of Thomas T. Goldsmith, Jr., *DuMont's* director of research, "we feel that many characteristics of color television have not been sufficiently investigated to warrant standardization for commercial operation at this time." CBS, always over-sanguine, had predicted in 1940 that color would go to town in 1941. "Further research is necessary."

OTHERS CONCURRED with this view, experts from half a dozen companies estimating that, instead of two years, it would be five at least—perhaps more. Another objection to the CBS system—"sequential" is the technical name—flicker trouble had led to technical compromises that made it less flexible than the so-called "simultaneous" system. This point was made by E. W. Engstrom, research chief at *RCA.* He was backed up with highly technical reasons presented by G. H. Brown, a second researcher for *RCA* and the National Broadcasting Company. Another anti-CBS witness was Paul Raibourn, a vice-president at *Paramount,* who said that "after forty years of development of color processes, and in spite of over thirty feature pictures produced in color in 1944 and 1945, the academy award winners and chief box office hits were (colorless) 'Going My Way' and 'Lost Week-

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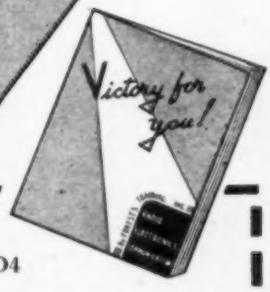

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SPOT RADIO NEWS

End.'" Black-and-whites are easier on the eyes, he believes. So, why all the rush?

RAIBOURN'S STATEMENT ON COLOR was condemned as "the sheerest irrelevance" by Dr. Selig Hecht, Columbia University biophysicist and world-famous specialist in optics, testifying for CBS. CBS colorcasts, he also testified, were "bright and realistic," showing "good contrast, plenty of detail . . . well-saturated colors." To the charge that CBS color could not be teamed with current black-and-white, Dr. Peter C. Goldmark, inventor of the CBS system, answered with equal emphasis. The two could be made compatible "on the same basis as FM and AM," he declared. "The solution," he explained, "is not converters but rather combination receivers which have an FM and an AM band. The CBS dual band television receiver is the television counterpart of a combination FM-AM receiver." Other CBS representatives replied to charges that the CBS system was inefficient by pointing out that it proved highly successful after more than 188 field tests.

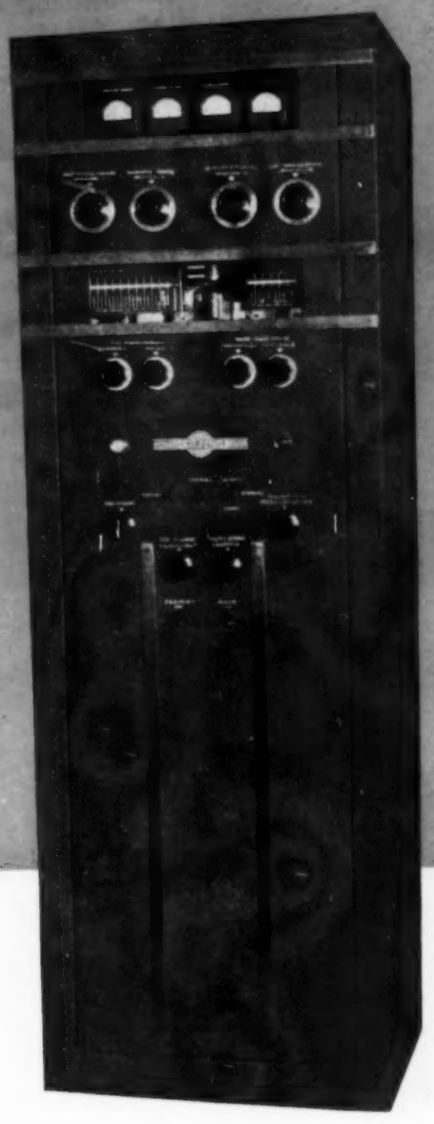
ATTENDING THE HEARINGS were an impressive collection of notables. There were even a couple of observers from the Russian Purchasing Commission. Among other witnesses for CBS were T. A. M. Craven, vice-president of the Cowles Broadcasting Company, and William B. Lodge, CBS director of general engineering. For the opposition: F. J. Bingley of *Philco*, G. L. Beers of NBC, W. R. G. Baker for an RMA engineering committee, G. H. Brown of *RCA* and NBC, David B. Smith of the RMA engineering department, and R. D. Kell of *RCA* and NBC.

FOOTNOTES: All evidence made one fact clearly apparent; despite bugs and regardless of how color will eventually be introduced into the radio picture, it is coming along nicely, thank you, and will play a leading role in the not-too-distant postwar world. . . . Some testimony might prove helpful to movie-goers. CBS authorities testified that the best place to view television was sitting seven times as far away from the screen as the screen is high. Opponents claimed that four times was the proper distance. We would have claimed that in most Washington theaters you have to stand up, but nobody asked our expert testimony. . . . Small television screens, all agreed, are harder to watch than large ones. . . . Mostly, the hearings were solemn but there were a few laughs, as when Mr. Raibourn of *Paramount* introduced into the evidence a color photo of a gal and a black-and-white of another gal, the black-and-white shot being the more attractive. But so was the gal. . . . Everybody who testified, the Commis-

(*Continued on page* 102)

How you will benefit by using the Collins 30K-2

Ground Station Radio Transmitter



The new Collins 30K-2 embodies certain design features that are of outstanding benefit to owners who employ radio communication from point to point, ground to plane, or shore to ship. This 250 watt radio transmitter can be pretuned to any two frequencies between 2.0 mc and 30.0 mc. Relay operation of all r-f circuits, including antenna tuning, provides instantaneous frequency shift.

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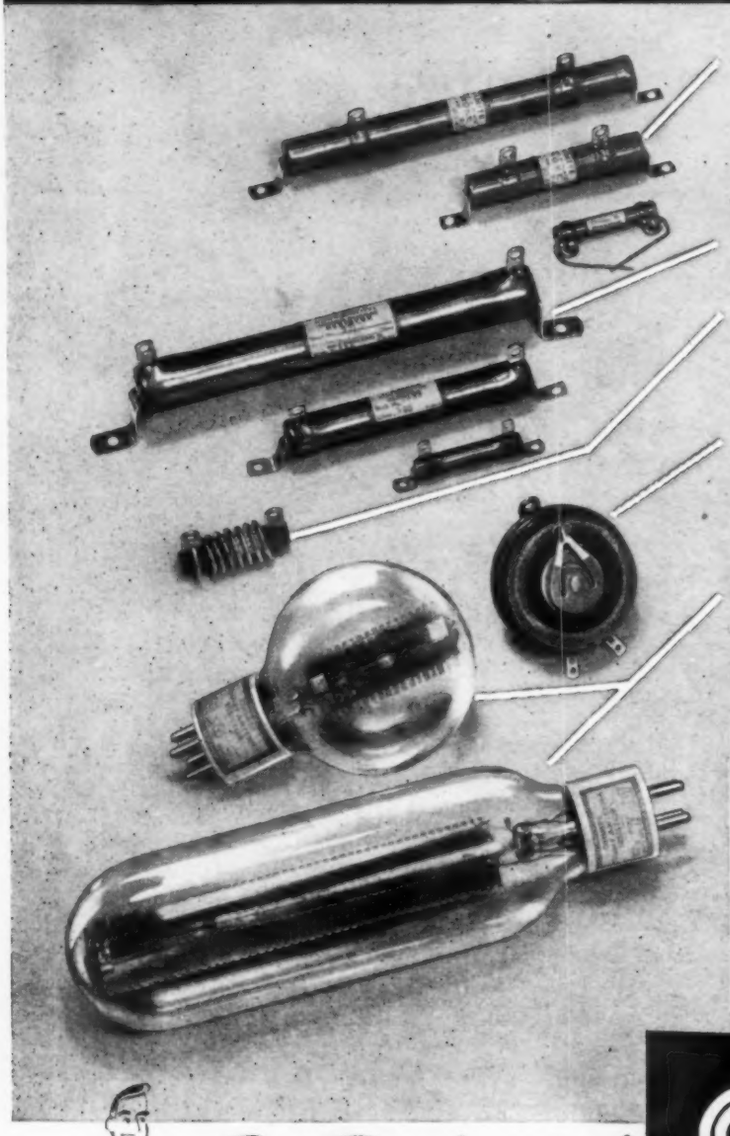

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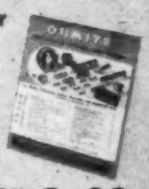
PARASITIC SUPPRESSORS—For the suppression of u.h.f. parasitic oscillations. Consists of a 50-ohm non-inductive resistor and .3 microhenry choke in parallel.

DIRECTION INDICATOR POTENTIOMETER—A compact, low cost unit used in a simple potentiometer circuit with an ordinary 0-1 milliammeter to indicate, remotely, the position of a rotary beam antenna. For complete information, write for Bulletin No. 128.

DUMMY ANTENNAS—Glass sealed, non-inductive, non-capacitive, constant resistance units used to check R. F. power, transmission line losses, and line to antenna impedance match. Made in 100 and 250-watt sizes with various resistances. For complete information, write for Bulletin No. 111.

Write on Company Letterhead for Stock Catalog No. 19

Gives valuable data and information on resistors, rheostats, chokes, tap switches, and other units. Send for your copy.



OHMITE MANUFACTURING CO.
4884 Flournoy St. Chicago 44, Ill.

Be Right with

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RHEOSTATS • RESISTORS • TAP SWITCHES

Grasp the NEW OPPORTUNITIES in RADIO ELECTRONICS AND TELEVISION NOW!

Modern Radio — FM Broadcast and Reception — Television — Industrial Electronics; Power, Control, Communications — new equipment and methods demand new technical ability and experience. Keep up to date with the latest.

MODERN RADIO EQUIPMENT FOR YOU TO USE AND KEEP

The very essence of National Shop Method Home Training is EXPERIENCE. You get actual experience by working with modern Radio and Electronic equipment—building many types of circuits. You may build a fine, long distance MODERN SUPERHETERODYNE, signal generator, miniature radio transmitter, audio oscillator, etc.—many other standard actual operating pieces of equipment—conduct cathode ray and other experiments. This practical work advances with your training—YOU LEARN BY DOING!

Shop Method Home Training

By a Real Established Resident School with its own FM Studios, Shops and Laboratories.

TRAIN WITH ADVANCED TECHNIQUE

The good jobs in Radio Electronics now go to the men who are equipped to handle them. It takes training and experience. National Schools, one of the oldest and largest trade schools in the country, makes it possible for you to get this training right in your own home IN YOUR SPARE TIME.

National maintains modern resident training Studios, Shops and Laboratories where instructors and engineers are working constantly to improve training methods. SHOP METHOD HOME TRAINING is a logical extension of this practical system.

A FREE lesson that shows you how practical and systematic this new training method is will be sent you without obligation. You may keep and use this lesson to prove to yourself just how practical National Training really is.

Get one of the many NEW JOBS that demand new techniques and methods in Modern Radio. Get your share of the NEW BUSINESS that servicing the new sets and equipment demands. Experts agree that Radio, Television and Electronics present opportunities much greater than ever before!

Radio is expanding with far-reaching improvements in reception. No one knows yet how great the Television market will be. Electronics will touch almost every walk of life—in industry and in the home.

TURN YOUR INTEREST IN RADIO INTO A CAREER THAT WILL ASSURE YOU SUCCESS AND SECURITY.

FIND OUT WHAT NATIONAL TRAINING CAN DO FOR YOU

Where do you stand today in modern industrial progress? What does the future hold for you? You owe it to yourself to investigate this opportunity. With National Training YOU GET AHEAD FAST—you may step into a good position or start a business of your own, with little capital, **even before you complete your National Course.**

Fit yourself for a career of independence, good earnings, success and security in one of the fastest growing fields in industry. For full information, just send your name and address on the coupon and mail it TODAY.

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This big book presents the facts about the field of Electronics and your opportunities in it together with full information about the advanced National Training. Read it and make up your own mind that National Training will equip you for a great future. No salesman will call on you from National. The book is FREE with your sample lesson. Clip and mail the coupon TODAY!

See What National Training Has Done For These Men

National Shop Method Home Training wins good jobs, independence and security. Take the word of National men who have established records in their favorite Radio, Television, or other branches of Electronics.

Clifford Hannah, Portage La Prairie, Manitoba, Canada, writes: "My training has brought results as I'm in line for another raise thanks to National's encouragement and thorough training."

From O. K. Ivey, Washington, D. C., comes this endorsement: "I believe National offers the best course to be had . . . Keep up the good work."

Joseph Michel, Jr., Granite City, Illinois, writes: "I am enthused with National training. I am now earning $225 a month as a radio operator and technician and $20 a week more in my shop at home.

Here's a statement from R. R. Wright, Blackfoot, Idaho: "Due to my training at National I was selected to instruct in the laboratory work of Navy and Marines."

Read what other enthusiastic students have written about National Training in the big 40 page book we will send you.

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4000 South Figueroa Street, Los Angeles 37, California

(Mail in envelope or paste on penny post card)

Mail me FREE the two books mentioned in your ad including a sample lesson of your course. I understand no salesman will call on me.

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☐ **Check here if veteran of World War II**

A SIGN OF SUCCESSFUL SERVICING

Bradley's has all fifteen RIDER MANUALS

A leading radio publication recently featured Bradley's of Red Bank, N. J. on an editorial spread, which told of the profitable efficiency of its service department. Characteristically, Bradley's has all fifteen RIDER MANUALS, depending upon them for authoritative information supplying all necessary servicing data on American-made receivers issued from 1930 to 1947.

From no other single source is this information available. In no other way can you have at your fingertips the information you need to diagnose troubles in any and all radio receivers that come to your shop for repair; receiver schematics, voltage data, alignment data, resistance values, chassis layouts and wiring, and trimmer connections.

Volume XV, covering sets issued during 1946, includes the exclusive Rider "clarified-schematics" which break down the composite diagrams of hundreds of complicated multi-band receivers into *individual* schematics of each circuit as it exists with each turn of the wave band or equipment switch.

Also with each copy of Volume XV is included the 150 page "How It Works" book, a practical guide to the theory of operation of the new technical features in the latest receivers. These exclusives are but two of the many important features in Volume XV, which also includes all popular "Ham" communication receivers, Scott receivers, Magnavox RA combinations and record player combinations.

RIDER MANUALS provide a systematic, compact, indexed data service, always in order, always ready with the information you must have for efficient, time-saving, profitable servicing. Year after year, after year, RIDER MANUALS keep pouring out profits for servicemen. Owners of Volume I, who bought it 17 years ago are still deriving benefits from it.

In spite of greatly expanded production, demand for RIDER MANUALS still exceeds supply. Place your order today.

VOLUME XV — JUST OUT!

2000 pages, plus 150 page "How It Works" Book
$18.00 complete

Volumes XIV to VII (each volume)	15.00
Volume VI	11.00
Abridged Manuals I to V (one volume)	17.50
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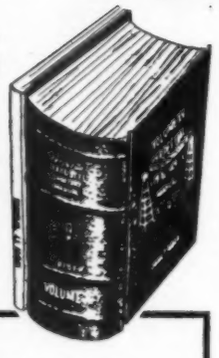

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Inside the Vacuum Tube — Solid concept of theory and operation . . . $4.50

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A-C Calculation Charts — Two to five times as fast as slide rule 7.50

Hour-A-Day-with-Rider Series—
On "Alternating Currents in Radio-Receivers"
On "Resonance & Alignment"
On "Automatic Volume Control"
On "D-C Voltage Distribution" $1.25 each

This new Rider Book, soon to be announced, will be of lasting usefulness to everyone interested in any phase of radio.

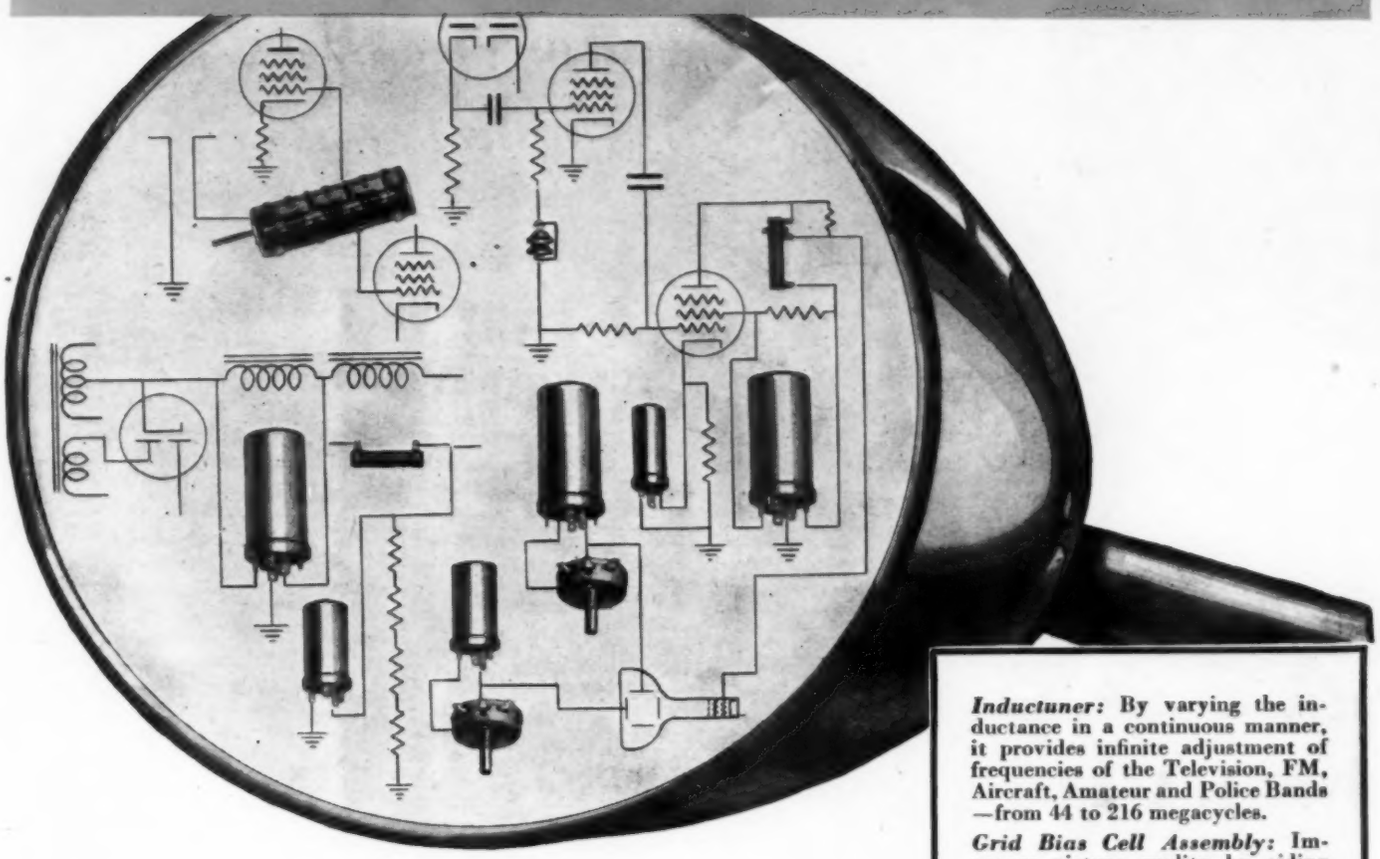
JOHN F. RIDER, PUBLISHER, INC.

404 FOURTH AVENUE, NEW YORK 16, N. Y.

Export Division, Rocke International Corp., 13 E. 40th St., New York City. Cable ARLAB

RIDER MANUALS
MEAN SUCCESSFUL SERVICING

Mallory Contributions to Television



ANTICIPATING the day when servicing of television sets will be as common as present-day servicing of radio sets, Mallory has long been engaged in planning, designing and building television components.

The result of this foresight is shown in the typical television circuits illustrated above—circuits in which no less than ten different Mallory parts find an important place. Three of these parts—the Inductuner*, the Videocoupler and the Grid Bias Cells—are of exclusive Mallory design.

The important point about these products is that they conform to standards for which Mallory is famous. Each in its own right is a true "Approved Precision Product." Each has the earmark of premium quality. You expect more and get more from Mallory components. That's true, too, of these television products.

Reg. U. S. Pat. Off.

Inductuner: **By varying the inductance in a continuous manner, it provides infinite adjustment of frequencies of the Television, FM, Aircraft, Amateur and Police Bands —from 44 to 216 megacycles.**

Grid Bias Cell Assembly: **Improves picture quality by aiding low frequency response and effectively eliminating stray pick-up.**

Videocoupler: **Widens frequency response, resulting in better picture definition.**

FP 550 Capacitor: **A unique decoupling and screen bypass capacitor.**

10 Watt Vitreous Enamel Resistor: **Used as a voltage dropping or bleeder resistor in low voltage power supply.**

WP 540 Capacitor: **Bypass for vertical centering.**

WP 510 Capacitor: **Bypass for horizontal centering.**

WP 505 Capacitor: **Bypass in compact container for video stage cathode circuit.**

FP 135 Capacitor: **Filter in low voltage power supply; effectively eliminates 60-cycle "hum band" distortion.**

Carbon Controls: **Used as tone, volume and contrast controls. (Not shown.)**

Wire Wound Controls: **Used for horizontal and vertical centering.**

P. R. MALLORY & CO. Inc.

MALLORY

VIBRATORS . . . VIBRAPACKS* . . . CAPACITORS . . . VOLUME CONTROLS . . . SWITCHES . . . RESISTORS . . . FILTERS . . . RECTIFIERS . . . POWER SUPPLIES.

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P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Now

MORE ACCURATE FM-AM RECEIVER TUNING BY MEANS OF KEN-RAD'S REVOLUTIONARY NEW TUBE!

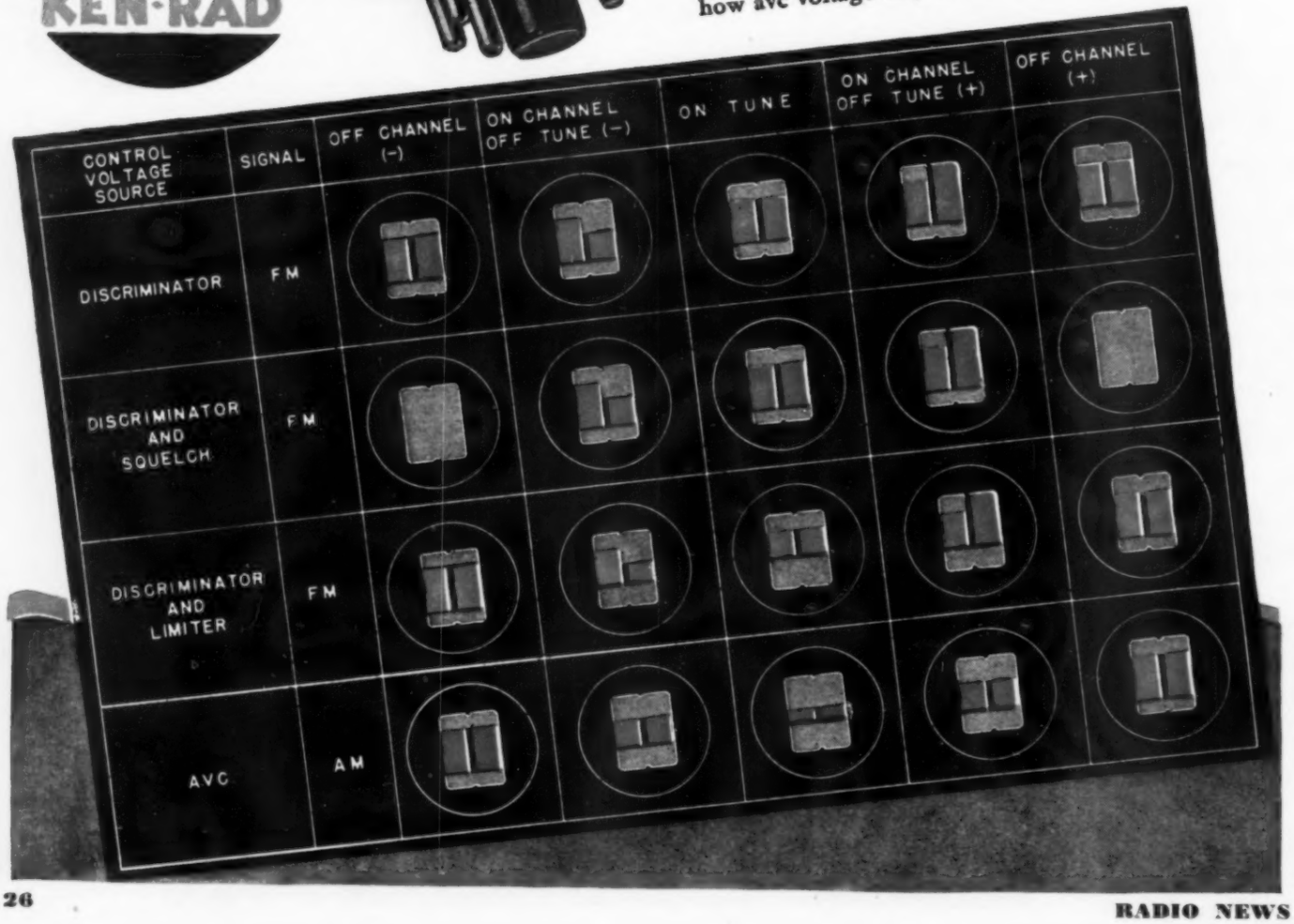
K
KEN-RAD

THE 6AL7-GT ELECTRON-RAY INDICATOR TUBE

General Electric research, plus Ken-Rad development work, are responsible for the brilliant new 6AL7-GT indicator tube—most modern step in the direction of fast, accurate receiver tuning, FM and AM.

An electron-ray tube, twin light patterns appear on a fluorescent screen at the end of the glass bulb. These take the form of green bands which vary in depth according to changing voltages brought about in the process of tuning.

Extremely close FM discriminator tuning may be accomplished by matching depths of the 6AL7-GT's light patterns. How the patterns appear to the eye under various off-channel, on-channel, off-tune, and on-tune conditions, is diagrammed below. Three FM circuit applications are shown. A fourth—AM—illustrates how avc voltage may be used for tuning purposes by



New IN PRINCIPLE IN SIMPLICITY AND RELIABILITY!

checking the depth of the two light patterns working as a unit.

Easy to see and read . . . Previous indicator tubes, developed for AM, have had reflecting targets, giving poor visibility because cathode and deflecting plates were placed in front of the screen, making it necessary to mask out the center. The fluorescent screen of the new Ken-Rad FM-AM 6AL7-GT is transparent, with electron-ray mechanism located *behind*, not before the image, thus offering no obstacle to vision.

Ken-Rad is consistently ahead with new tube developments—meaning that Ken-Rad dealers, and servicemen installing Ken-Rad tubes, march in the van of radio progress. Pioneering work by Ken-Rad, as typified by this great new 6AL7-GT indicator tube, enables you to serve *all* your clients better, whether their radio sets be AM or FM, old-style or new, portables or console models. . . . Install Ken-Rad tubes for greater owner satisfaction, and resulting bigger profits!

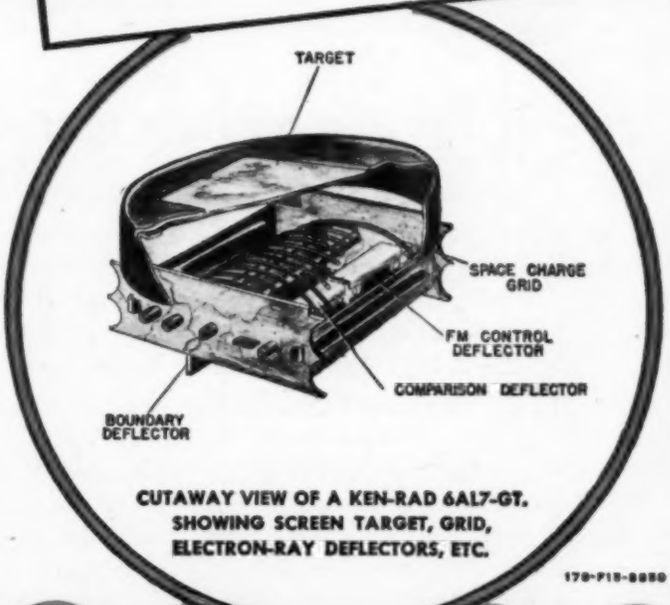
KEN-RAD'S OUTSTANDING NEW INDICATOR TUBE WILL BE ON VIEW AT THE CHICAGO PARTS SHOW, MAY 13 THROUGH 16. SEE HOW IT TUNES CIRCUITS TO HAIRLINE ACCURACY WITH EASE AND PRECISION! YOUR VISIT TO THE KEN-RAD DISPLAY WILL BE ONE OF THE HIGHLIGHTS OF YOUR CHICAGO TRIP. A CORDIAL WELCOME AWAITS YOU!

TYPICAL OPERATING CONDITIONS
(Indicator service)

Heater voltage	6.3 v
Heater current	0.150 amp
Target voltage	315 v
Voltage, deflection electrodes 1, 2 and 3	0 v
Cathode resistor (approx)	3,300 ohms
Deflector sensitivity (approx)	1.0 mm/v
Fluorescence cut-off, grid volts (approx)	—6.0 v

● The 6AL7-GT's principle of operation is unique and effective. In the cutaway drawing at the right, note that the three deflection electrodes are close to the cathode, with this whole assembly in turn separated from the target by the grid. The latter operates either at cathode potential, or at a few volts negative with respect to the cathode. Because electrons move slowly in the area between cathode and grid, the 6AL7-GT's deflectors easily control the position of the electron beams on the target. Increasing the negative voltage on the grid slows down the electrons still more, augmenting their response to the deflectors' pull and thus heightening the tube's sensitivity.

More detailed technical information and performance data on the 6AL7-GT will be furnished promptly on request. If you manufacture electronic equipment, Ken-Rad tube engineers gladly will work with you to apply the new Indicator Tube to radio receivers or test equipment you may have on your drawing-boards. Communicate direct with Ken-Rad at the address below.



CUTAWAY VIEW OF A KEN-RAD 6AL7-GT, SHOWING SCREEN TARGET, GRID, ELECTRON-RAY DEFLECTORS, ETC.

179-P1B-8850

Behind KEN-RAD radio tubes stands Electronics' first and greatest name — GENERAL ELECTRIC

KEN-RAD

DIVISION OF GENERAL ELECTRIC COMPANY SCHENECTADY, NEW YORK

Television today is clearer, sharper, and brighter—thanks to the improved kinescope, or picture tube, perfected at RCA Laboratories.

The Picture Tube that brought "life" to television

The screen on your home television table model receiver is the face of a large picture tube. And the skater you see on the face of the tube is the *identical twin* of the skater being televised.

Pioneering and research in RCA Laboratories led to the development of this tube which allows none of the original realism to be "lost in transit." It reproduces everything the television camera sees, shows you every detail, keeps the picture amazingly lifelike and real.

An RCA Victor television receiver brings you all the action, drama and excitement that you'd enjoy if you were at the event in person—and on top of that it's all brought to you in the comfort of your own home . . . you don't have to move from your favorite chair.

RCA Laboratories has made possible outstanding advances in every phase of television. And for television at its finest, be sure to select the receiver bearing the most famous name in television today—RCA Victor.

Radio Corporation of America, RCA Building, Radio City, New York 20. Listen to the RCA Victor Show, Sundays, 2:00 P. M., Eastern Standard Time, NBC Network.

Exclusive "Eye-Witness" feature on all RCA Victor home television receivers "locks" the picture in tune with the sending station. It assures you *brighter, clearer, steadier* pictures. If television is available in your vicinity, ask your RCA Victor dealer for a demonstration.

RCA **RADIO CORPORATION of AMERICA**

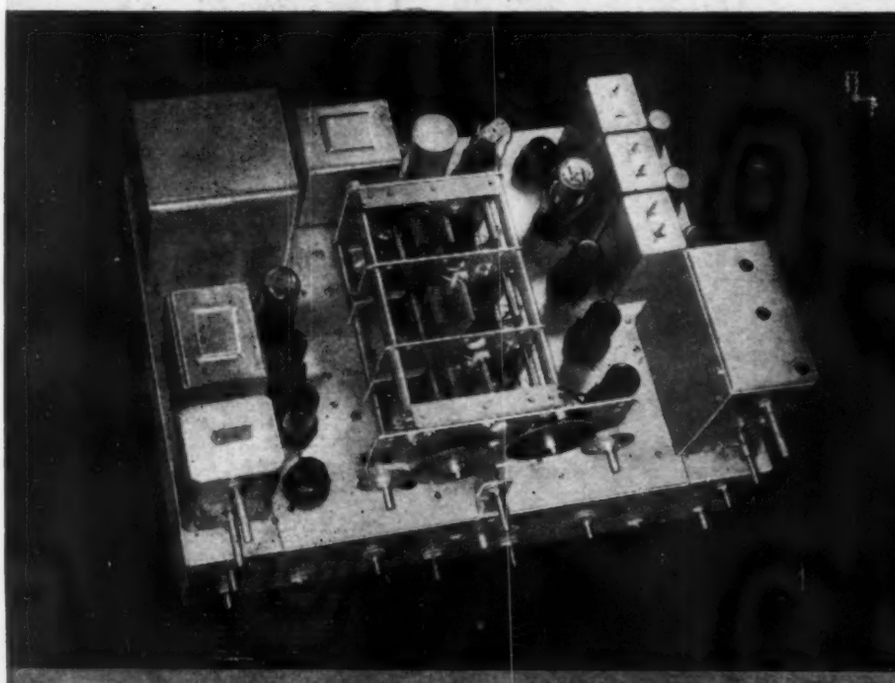
READY NOW

IN ANSWER TO HAMS' DEMANDS

EST. NC 1914

Hams around the world have been National's collaborators in creating the NC-173—ready now after five years of intensive research. Here are some of the advantages this 13-tube superheterodyne receiver offers:

- The NC-173's newly designed adjustable threshold double diode noise limiter—working on *both phone and CW*—has an extremely high limiting efficiency because of the short recovery time.
- Voltage regulated circuits give the NC-173 high stability and less drift for changes in powerline voltage. The pitch of code characters barely changes—even over extended listening periods.
- The S-meter circuit allows signal strength recordings to be taken on either *phone or code.*
- Works equally well on coaxial feedline, single-wire, directional or balanced antenna.
- AC powered. Will also operate on battery for portable or emergency use—110/120 or 220/240 volts, 50/60 cycle. Frequency range .54 to 31 and 48 to 56 MC. (Includes calibrated band spread on 5, 10, 11, 20, 40 and 80 meters).
- Ask your dealer to let you see and hear the new moderate-priced NC-173.



THE NATIONAL NC-173

NATIONAL

COMPANY, INCORPORATED

MALDEN, MASS.

THE MOST DISTINCTIVE NAME IN RADIO COMMUNICATIONS

Metropolitan

NO LOWER PRICES ANYWHERE!

SENSATIONAL VALUE!!

THE NEW MODEL 111
AC-DC QUALITY MULTITESTER

A new pocket size volt-ohm-milliammeter with features never before available in an instrument of this size and price.

SPECIFICATIONS:

D.C. Voltmeter: 0-5-50-250-500-2,500 volts. A.C. Voltmeter: 0-10-100-500-1,000 volts. Output Voltmeter: 0-10-100-500-1,000 volts. D.C. Milliammeter: 0-1-10-100 milliamperes. D.C. Amperes: 0-1-10 amperes. Ohmmeter: 0-500-100,000 ohms; 0-1 megohm. Decibel Meter: —8 to +55 db. The scale is calibrated for line of 500 ohms impedance. For other impedances correction charts are supplied. Model 111A, open face as shown.

Complete with instructions..... **$16.85**

Model 111P, in portable case (not illustrated) including testing leads and complete instructions..... **$19.85**

The New Model B-45
BATTERY OPERATED SIGNAL GENERATOR

for servicing AM, FM and Television Receivers

Self-modulated Signal Generator, providing a highly stable signal. Generates R.F. frequencies from 150 Kilocycles to 50 Megacycles (150 Kc. to 12.5 Mc. on Fundamentals and from 11 Mc. to 50 Mc. on Harmonics). R.F. is obtainable separately or modulated by the Audio Frequency.

Direct reading—all calibrations are etched on the front panel. Complete with shielded test lead, self-contained, batteries and instructions.

Net..... **$27.75**

Model 689—IF

The Model 689—IF

WESTON OHMMETER

A convenient, pocket size ohmmeter for checking circuits by the resistance and continuity method. The energy for the resistance readings is supplied by a self-contained 1.5 volt No. 2 standard large flashlight cell. Variation in battery voltage is compensated by a magnetic shunt adjustable from the outside of the case. Built to meet U.S. Army Requirements for Accuracy and Durability!

This Ohmmeter also has a double range 0-10 and 0-1,000 ohms for the accurate measurement of low resistance values.

Model 689-IF comes complete with operating instruction, test leads and LEATHER CARRYING CASE.

LIST PRICE $25.50.....Our Price **$14.85**

Leather Case

MAIL ORDERS FILLED

Same Day Received!

We carry nearly 5,000 instruments in stock. All models listed below are available for *immediate* delivery.

PRECISION APPARATUS INSTRUMENTS

832S—31 Range AC-DC Multi-Range Tester	$23.04
844P—34 Range AC-DC 600 volts AC and DC VOLT-OHM MILLIAMMETER.	32.20
856P—44 Range Super-Sensitive, 600 volts AC-DC TESTER 20,000 ohms per volt DC	49.94
864—AC-DC VOLT-OHM-DECIBEL-MILLIAMMETER with large 9" meter	59.60
912P—Dynamic Mutual Conductance Tube Tester	61.20
E-200—A.M.-F.M. and Television Signal Generator	64.15
EV-10P—6,000 volts AC and DC Vacuum Tube Multi-Range-Meter	71.81
920P—Combination Dynamic Mutual Conductance Tube Tester, Battery Tester and 33 Range AC-DC Multi-Range Set Tester	84.20
954P—Combination Mutual Conductance Tube Tester, Battery Tester and 37 Range Super-Sensitive AC-DC Multi-Range Set Tester, 20,000 ohms per volt DC	99.20

WESTON ELECTRICAL INSTRUMENTS

697—Volt-Ohm Milliammeter	$26.45
779—Super-Sensitive Analyzer	76.45
785—Industrial Circuit Tester	103.60
798—Mutual Conductance Tube Checker and Analyzer	187.10

SUPREME INSTRUMENTS

543—Multi-Tester	$18.95
589—Tube and Battery Tester	48.95
599—Tube and Set Tester	62.50
565—Vacuum Tube Voltmeter	63.50
576—Signal Generator	68.95
804—Combination Tube and Set Tester	89.50
546—Oscilloscope	89.75

McMURDO SILVER CO.

905—"Sparx" Dynamic Signal Tracer	$39.90
904—Capacitance Resistance Bridge	49.90
900—"Vomax" Vacuum Tube Voltmeter	59.85
906—A.M.-F.M. Signal Generator	89.90

RADIO CITY PRODUCTS

447—Multi-Tester	$17.95
448—Multitester	24.50
322—Dynoptimum Tube Tester	41.50
461P—Sensitive Multi-Tester	42.63
664—Electronic Multi-Tester	45.00
705—Signal Generator	49.50
315—Rollchart Tube Tester	59.50
802N—Combination Tube and Set Tester	59.50
668—V.T.V.O. Capacity Meter	73.01
805—Combination Tube and Set Tester	89.50
665A—V.T. "Billionaire" Insulation Tester VTVM	92.61

SUPERIOR INSTRUMENTS

CA-11—Signal Tracer	$18.75
670—Super Meter	28.40
CA-12—Audible-Visual Signal Tracer	34.85
450—Tube Tester	39.50
650—Signal Generator	48.75
400—Electronic Multi-Tester	52.50
600—Combination Tube and Set Tester	62.50

SHALLCROSS MFG. COMPANY

Decade Resistance Boxes	$13.50
Portable Galvanometers	27.50
630—Wheatstone Bridge	75.00
637—Kelvin Wheatstone Bridge	100.00
638-2—Kelvin Wheatstone Bridge	150.00

ALLEN B. DUMONT LABORATORIES

185A—Electronic Switch and Square Wave Generator	$105.00
274—5" Oscilloscope	115.50

WATERMAN "Pocket" Oscilloscope	55.00
MONITOR Crystalliner Signal Generator	57.50
Bliley Crystal Controlled Signal Generator	69.50
200—Electronic Measurements Mutual Conductance Tube Tester	49.85

TERMS: 25% deposit, balance C.O.D. or full payment with order.

SEND FOR FREE CATALOG!

Metropolitan ELECTRONIC & INSTRUMENT CO.

Dept. R, 6 MURRAY STREET
NEW YORK 7, N. Y., U. S. A.

Cable Address: METRONICS
Phone: BArclay 7-5556

Within the INDUSTRY

SAMUEL INSULL, JR. has joined *Stewart-Warner Corporation* as assistant to James E. Knowlson, chairman of the board and president of the company.

Since his separation from the Navy, where he served from August, 1943 to December, 1945 attaining the rank of commander, Mr. Insull has been vice-president of *Central Barge Company* of Chicago.

He was engaged in the utility business in Chicago from 1922 to 1938 and later was an insurance broker until beginning his Navy service.

* * *

LAZARE GELIN, who until recently served as export manager of *Lear, Incorporated,* will head a new organization which will handle all of the company's export work. The new company will be known as *Lear International Export Corporation,* with headquarters at 50 Broad Street, New York.

The complete *Lear* line of electro-mechanical products, aircraft navigation and communication instruments as well as their home radios will be handled by the new export firm.

Mr. Gelin, who has spent over fifteen years in the export field, has just completed a survey of the Central and South American markets and is expanding his activities to include the growing European and Indian markets.

* * *

PAUL B. ROFIELD has joined the sales department of the *Garod Radio Corporation* of Brooklyn, New York where, in addition to his sales duties, he will engage in the company's sales promotion activities.

Prior to his war service as a navigator in the 15th Air Force, Mr. Rofield was associated with several radio manufacturers in sales and sales promotion positions.

* * *

HARRY F. RANDOLPH, fifteen-year veteran at *RCA,* has been appointed General Plant Manager of the Tube Department of the *RCA* Victor Division, *Radio Corporation of America.*

Joining the company in 1932, he scheduled parts and materials for tube production and was later put in charge of metal tube production. Climbing steadily, his next step was assistant superintendent of metal and glass receiving tube manufacture. After helping to select the site and organize the plans for the *RCA* plant in Lancaster, Pa., he was made plant manager at Harrison, N. J. and given charge of glass tube production in Indianapolis.

Mr. Randolph will continue as acting manager of the Harrison, N. J. tube plant while adding to his duties the supervision and coordination of all the company's tube manufacturing activities.

* * *

GENERAL RADIO COMPANY of Cambridge, Massachusetts has recently started work on a new four-story addition to the company's main plant at 275 Massachusetts Avenue.

The new building, located at the corner of State and Windsor Streets in Cambridge, will add approximately 30,000 square feet to the company's manufacturing space. The addition will be used to house manufacturing operations now being carried on in rented quarters in addition to providing increased production facilities.

The plant is expected to be completed in the late spring or early summer.

* * *

JULIUS FINKEL, president of the *JFD Manufacturing Co.* of Brooklyn, N. Y., has named the *R. W. Farris Co.* of Kansas City, Mo. as sales representatives in Iowa, Nebraska, Kansas and Missouri.

The *R. W. Farris Co.* is a partnership between Mr. Farris, president of the Missouri Valley chapter of "The Representatives," and Zell S. Myers.

* * *

PEERLESS RADIO DISTRIBUTORS of Jamaica, Long Island have taken over the operation of the wholesale division of *Tung-Sol Lamp Works,* and will assume ownership of their New York warehouse and distribution plant.

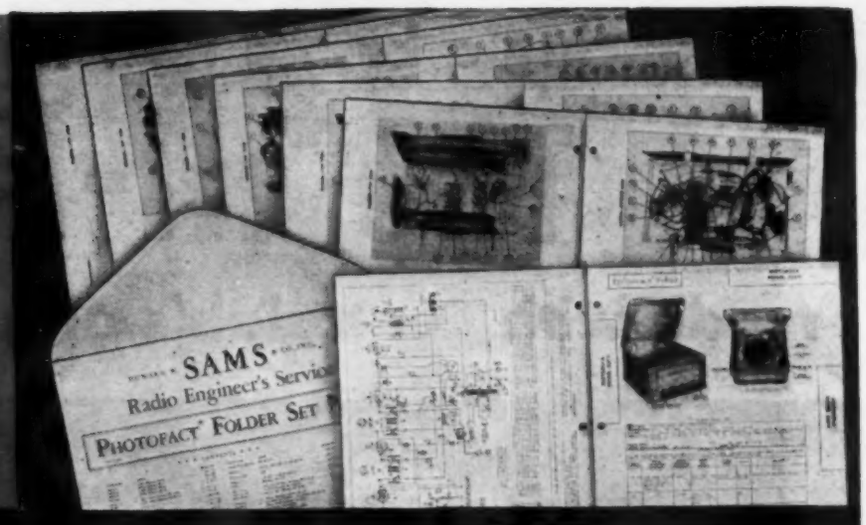
Mr. MacNatovitz, who formerly covered the territory of New York, Brooklyn and the Bronx for *Tung-Sol,* joins *Peerless* to head the New York office. The *Peerless* main office will remain in Jamaica, while the new office will be used to service New York customers.

* * *

ERNEST A. MARX, head of the television receiver division of *Allen B. DuMont Laboratories, Inc.,* has been appointed chairman of the executive committee on affiliates of the Television Broadcasters Association. The duty of this

(*Continued on page* 132)

Old-Timers say: "Keep up the good work!"



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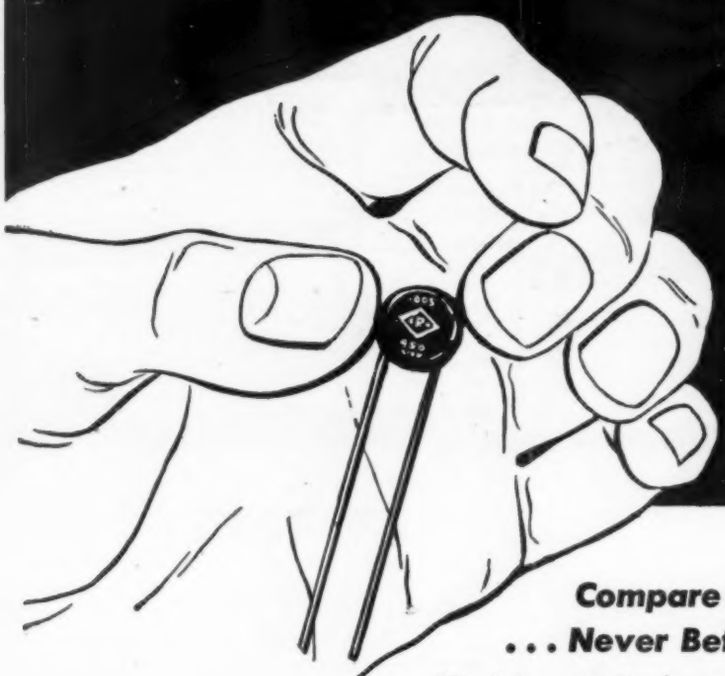

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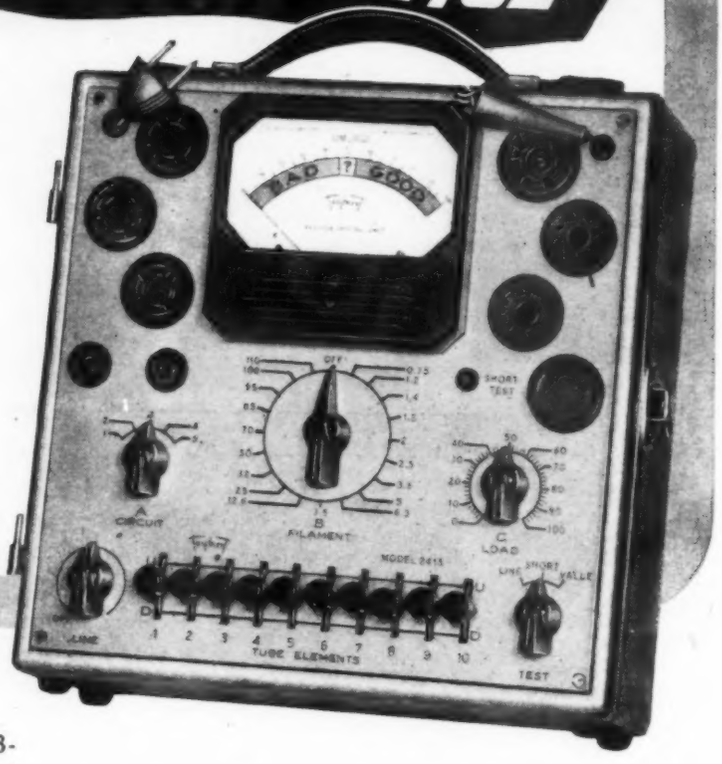

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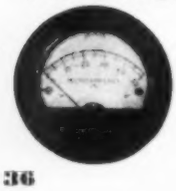

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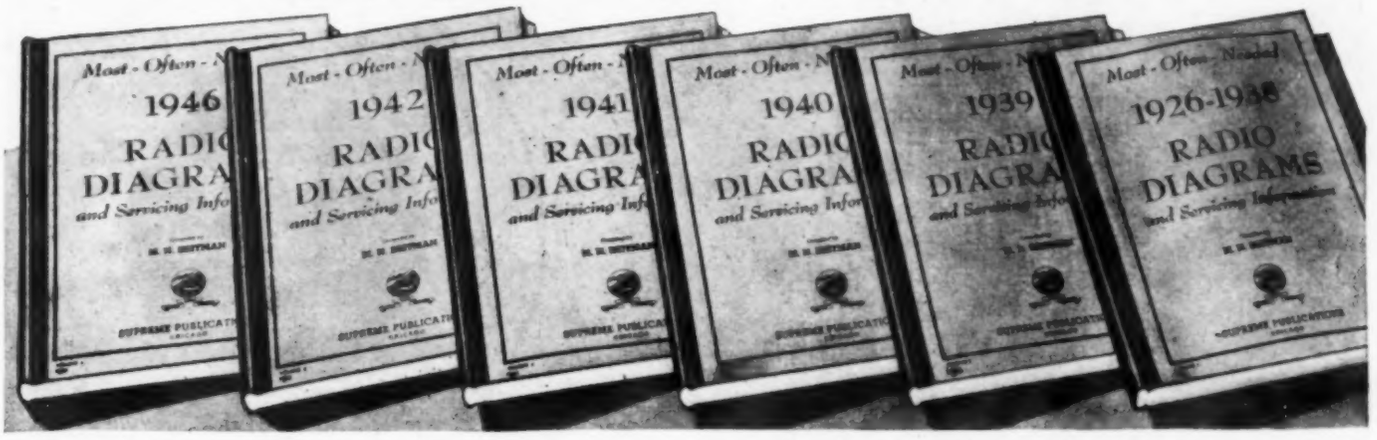

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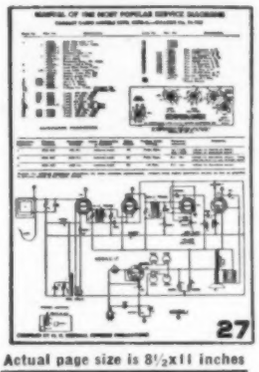

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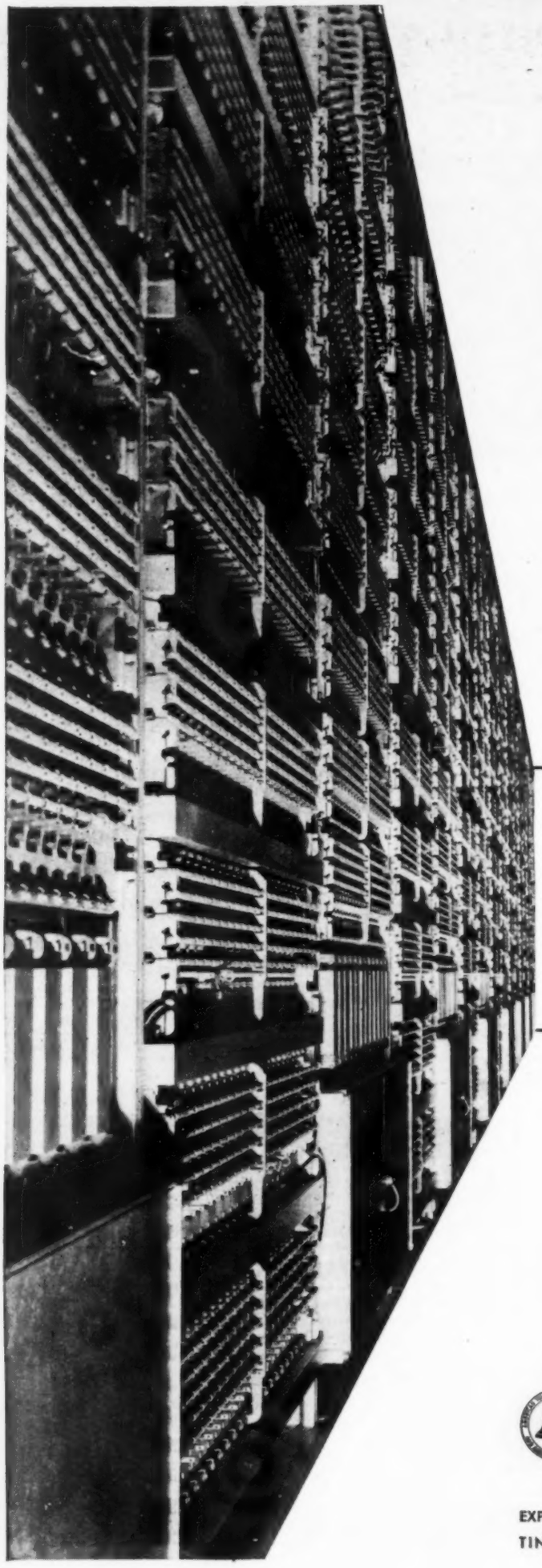

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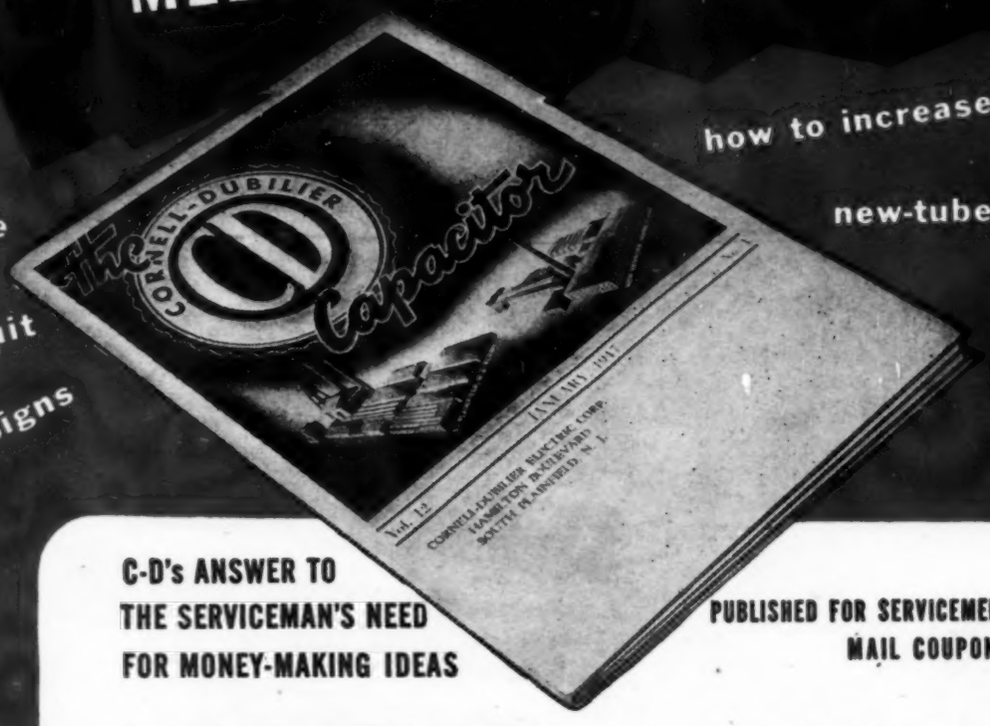

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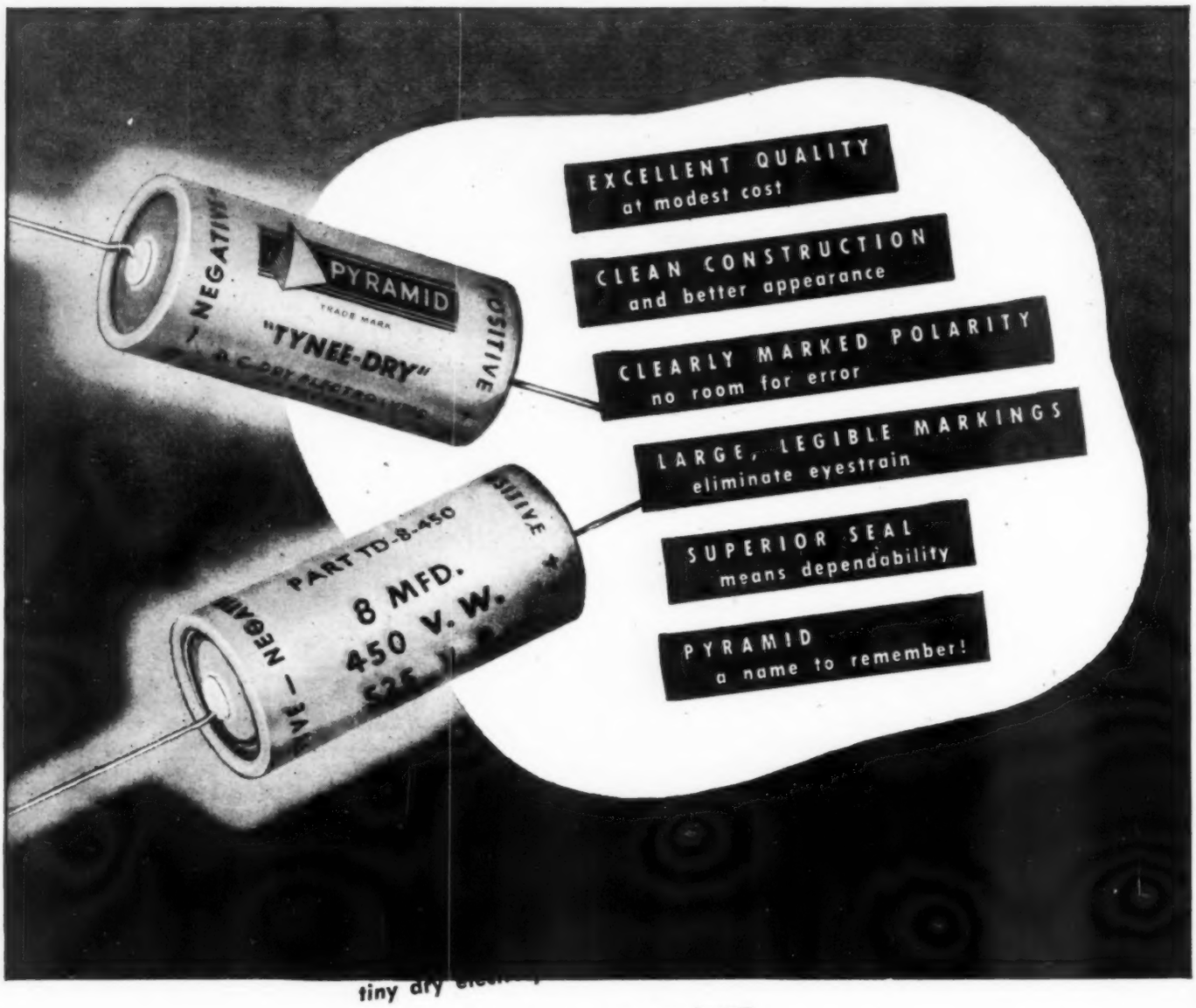

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The Modern DIVINING ROD

The Goldak Co. Model 520 metal locator. This type unit was used effectively by the British for the detection of land mines.

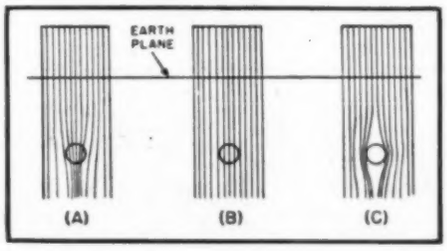
By
ALVIN B. KAUFMAN
Consulting Eng., Goldak Co.

The use of witch hazel, elm, and copper divining rods for locating water, oil, and metals has been replaced by modern electronic equipment. The author discusses various metal locators, their design and limitations.

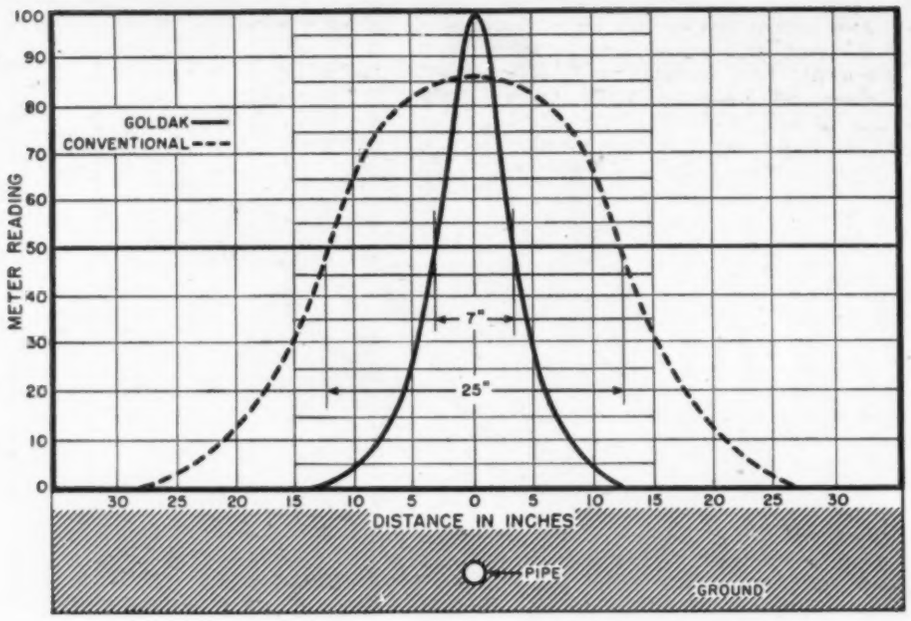
THERE have been many articles written describing electronic equipment used for the location of pipes, buried treasure and miscellaneous metallic ores. Many of these articles are erroneous in describing the theory of operation and performance. Numerous methods of detecting foreign bodies exist, and probably there are as many companies manufacturing and selling equipment as there are methods. There are, as yet, no set rules for comparing methods for results, taking into account of course weight, power, and the size and composition of the object to be detected. No single article can hope to do more than touch upon the many methods of electronic geophysical prospecting. The scope of this small article will cover mainly the three most prominent "radio" devices used for the detection of buried pipes and objects and will show the needs and necessary characteristics of each such instrument.

Before discussing the three prominent radio frequency methods for the detection of objects it might be best to define some of the common phrases, so carelessly used, with reference to metal detectors. There appears occasionally in literature and advertising matter reference to "penetration depth" of geophysical apparatus. This term has no practical significance *because the depth to which radiation will penetrate is ordinarily vastly greater* than the maximum possible "detection depth" of a given piece of equipment. For example, an apparatus which is stated to have a maximum penetration depth of, say, 20 feet, in all probability could not detect any object of practical size deeper than a foot or two. Thus it is grossly misleading to rate the detecting power of an instrument by the depth to which its radiation can penetrate. The term "detection depth" is often misused by quoting the distance at which an instrument will detect an object in the air. Unfortunately this detection range is considerably shorter when the detection must be accomplished through earth or water. As Heiland in his *"Geophysical Exploration"* and Jakosky in *"Exploration Geophysics"* show by curves, soils of different resistivity affect the penetration of the radio waves into the ground. Furthermore it is clearly shown, the higher the radio frequency, the less penetration. The magical sales word "Radar" is usually featured by newspaper writers when talking about mine detectors (one type of radio prospecting equipment) and their use. The principle of radar has not been used for the detection of buried objects! In the radar set, a transmitter sends out a short pulse which reflects from any object in its path and returns a signal to a radio receiver. This principle has been used at "audible" frequencies (seismic recording) for the detection of oil for quite a few years, but does not fall under the radio classification as there are no electromagnetic waves radiated.

Fig. 1. Magnetic flux field in earth. The conditions shown are with the transmission loop stationary over a circular body. (A) Magnetic material, d.c. field, (B) non-magnetic material, d.c. field, and (C) high frequency, a.c. field.



It might be well at this point to describe the effect that a buried metallic body has upon the magnetic flux field of a transmitting loop. This effect will vary directly as the frequency of the current in the transmitting loop and will show the differences between iron, copper, and gold. Fig. 1A shows the flux field distortion for a direct



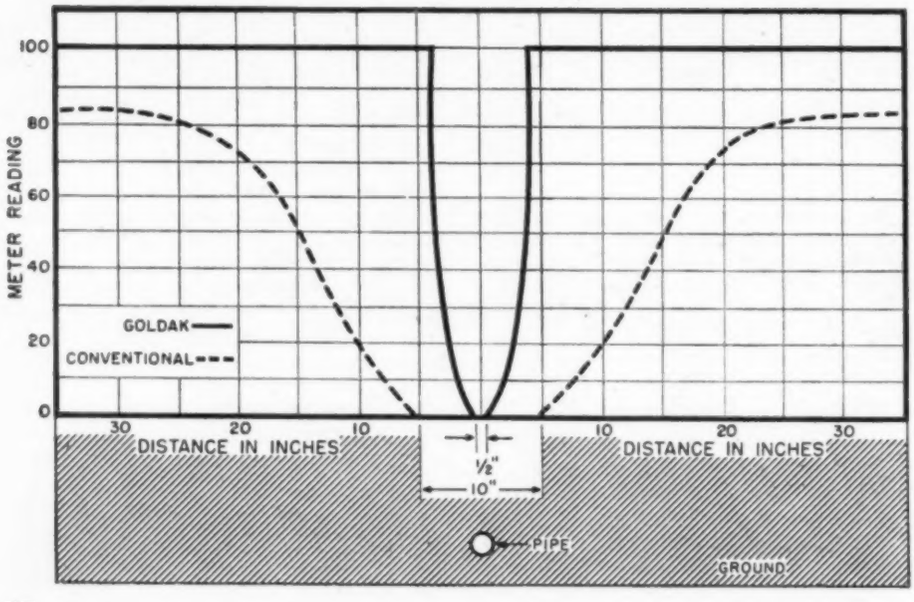
Sensitivity curve shows relative sharpness of positive signal of a modern metal locator as compared to the conventional prewar models.

current or very low frequency alternating current field near a metallic iron body. The flux, as with an electrical circuit current, takes the path of least resistance and so turns and flows *through* the metallic body. The inductance of the transmitting loop may be increased due to any added lines of force (higher Q) or the Q of the transmitting loop may be decreased by the added resistive component of the solid metal in the flux field. Fig. 1B indicates that copper, gold, or other non-magnetic bodies in such a field cause no flux field distortion, and therefore may only lower the Q of the transmitting coil by their addition of further resistivity to the circuit. Where the flux field results from a high frequency current in the transmitting loop, the field distortion will show the same effects for iron, copper, and gold *with but one exception*. This flux field distortion is shown in Fig. 1C. The eddy currents produced in the metallic object by this alternating flux cause a repulsion field to be set up and the consequent distortion of the flux field *away* from the metallic object. This *has not* been shown correctly in many articles and texts on this subject. In this high frequency field there may be a detectable power loss in the metallic object. There will be a definite lowering of the Q of the transmitting coil, due to the added resistive component accompanied by no increase in the flux strength. As previously mentioned, there is one exception to this flux field distortion, as produced by a high frequency current in the transmitting loop. If the metallic body consists of finely divided iron particles so as to form a crude "polyiron core" then the flux field produced will appear as in Fig. 1A. Here the Q will increase sharply with the increase of flux strength, with little increase in the resistive component.

The flux field frequency determines with solid iron where the magnetic properties are overcome by the eddy current phenomena. At a given frequency the inductive component may be stronger than the resistive component. Where this occurs it is possible to differentiate between iron and gold (or any non-magnetic conducting metal). The iron in this case will cause the Q of the transmitting loop to increase, while the gold will make it decrease, all of which can be detected with suitable equipment. As many treasures are buried in iron containers, this feature is of limited use. For the location of gold nuggets and stringers, in prospecting work, this feature may be of greater value.

From the described effects of the various metals upon a flux field, it is apparent that several methods of detection are available. These methods may be classified roughly into three groups. The two most commonly used are the "beat frequency" and the "balanced radio loop." The third method is more suitable to the laboratory than the field, namely the "bridge." The bridge system employs, as a rule, one search coil and three shielded coils connected to form a Wheatstone Bridge. This bridge may be supplied its power by an audio oscillator or a radio frequency oscillator as choice dictates. The bridge is balanced by suitable means and any unbalanced output, caused by detection, amplified to a suitable extent. Any change in Q of the search coil, whether up from polyiron or down from copper, will unbalance the bridge and create a signal. It would appear that this system is ideal, but the low percentage change in the coil Q with detection, in combination with the extraneous effects of the search coil capacity to green bushes, personnel, etc., causes such a poor ratio of signal-to-noise ratio and detection range that it is not too practical. The "beat frequency" method employs *two* radio frequency oscillators. One oscillator is fully shielded and built to be highly stable in frequency output. The second oscillator usually employs a Hartley or Colpitts circuit wherein the search coil is the oscillator tank coil. With this device, one oscillator is balanced against the other with their outputs fed into a nonlinear detector or mixer so as to produce a beat note in the detector headphone circuit. When the search coil passes by a metallic object, its Q changes. This change in Q in turn varies the one oscillator frequency, thus causing a change in the beat frequency rate. This change may best be heard when, with no signal, the oscillator frequency is adjusted to hear a one or two cycle beat note. With that adjustment there will be a greater percentage of change than at a high frequency beat. From the start it is apparent that the higher the radio frequencies used the greater the

Graph shows comparative sharpness of centering with Goldak trigger circuit.



change in the beat note or detection system for a given percentage change in the *Q* of the tank coil. *In the air* 2000 kilocycle oscillators give marvelous response to both capacity and metallic object changes. The capacity may be limited by the use of a Faraday shield and/or a balanced search coil circuit. However it is impractical to exceed 200 kilocycles for reasonable depth penetration and detection into the earth. Here there are two factors working against the instrument. Low frequency is required for depth penetration while high frequency is required for sensitivity. For these reasons this type of instrument has a limited use. For detecting small objects on the surface of the earth, it can perform excellently. The third and most successful type of instrument, the balanced loop, is described in the next paragraph.

The principle of the balanced radio loop is similar to that of the Wheatstone Bridge only in terms of magnetic flux rather than electric currents. The balanced radio loop system produces a strong magnetic field which is balanced out in a receiving and detecting unit so as to respond only to any distortion of the normal flux field. It is undesirable to have the transmitting oscillator respond to any *Q* or loading changes, especially where the receiving equipment has a narrow bandpass.

If a loop antenna is rotated about a vertical axis it picks up a minimum or null signal when its plane is parallel to the envelope of an approaching electromagnetic wave. The balanced radio loop system consists of two loops, the transmitting and detection loops, mounted at right angles to each other on a pair of rigid handles. This results in a null signal when the apparatus is in a region free of conductive bodies such as minerals or metals, but the distortion caused by a conductive body in the ground below the instrument will so distort the magnetic field that the balance is upset, thus indicating the conductive body. This unbalanced flux causes an alternating electrical voltage to appear in the receiving loop. As this alternating voltage is at radio frequencies it is impossible to hear, unless the oscillator is modulated and the receiver employs a detector. A second and better method is to have the oscillator unmodulated, and employ a beat frequency oscillator at the receiver to make the incoming unbalanced signal audible. This method is employed by the *Goldak* equipment, to be described later in this article, as a commercial version for the detection of pipes, etc. for the Bureau of Water & Power of several cities.

Strictly speaking, regardless of the detection method used, the radio equipment does not actually detect a metal or mineral but rather it detects the difference between the electrical conductivity of a disturbing body and the surrounding earth. In other words, a sheet of metal buried in fully mineralized ground or submerged in salt water is not subject to detection because of the insufficient difference between the conductivity of the metal and its surroundings. The difficulty here is exactly the same as that in trying to read black print on black paper or white print on white paper; lack of contrast prevents perception.

The *Goldak Company* of Los Angeles, California has, within the past few years, engineered two metal detecting units which have been used extensively. One unit, Model 520, was used by the British for the detection of land mines. The other unit, Model 599, operates similarly to the 520 but is different in construction and detection characteristics.

The Model 520 will detect objects as small as a penny or dime, whether copper, silver, or iron. This feature makes this instrument invaluable for the detection of lost rings, watches, and other small valuables lost *at the beach* or home. Detection at the beach can be highly successful in the dry beach sand, but less successful through salt water. Of course the preceding statement about the detection capabilities of this machine must sound exaggerated or there must be some catch. And there is! No machine has ever been made for the detection of a small object at *any* distance. This equipment will detect a large object four to six feet in the earth, but only several inches into the earth for a small object. The detection curve of size of object vs. depth

(*Continued on page* 122)

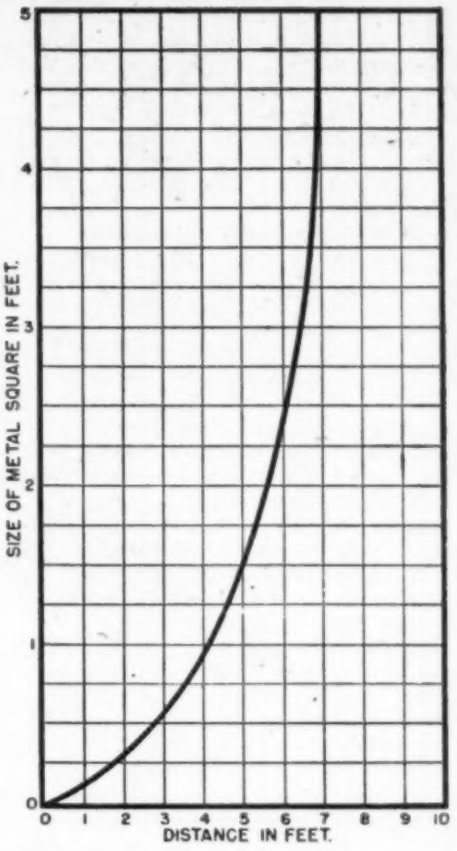


Fig. 2. Curve shows relation between size of object and detection depth (assuming ideal soil conditions) which can be obtained with modern metal locating equipment.

Pipe locator operated as an induction balance shows the approximate location of pipes and cables in the earth.

Here the operator is shown taking measurements to determine the actual depth of the object. The depth at which objects can be located depends, of course, on their size.

A Portable 80-40 Meter Rig

By
BYRON LINDSEY, JR., W4BIW

IF ON some rainy week-end you are possessed by the idea of building yourself a little portable rig, this may well be just what the doctor ordered. If the "fever" really gets you, you can complete this one for c.w. before the night time QRM sets in and get a signal on the air. The modulator can be built the next time it rains or when the next fever attack comes.

If you are strictly c.w., OK, this is a c.w. rig. If you are strictly a phone ham, all right, this is a phone rig too. If you are both, well we could go on—but suffice it to say, we aim to please all.

However, in order to get the best possible results for each type of service, let us first describe a strictly c.w. version and then add the one tube modulator, along with a few minor changes for the r.f. section to facilitate phone operation. The modulator is of the "snap-on" or "plug-in" variety and you can take it or leave it, as desired.

Please QRX a moment on the technicalities though, while we put in a few "selling points" here. First I would like to say that this basic circuit has been used at W4BIW for the past ten years with fine results. Several similar rigs have been built up here, and they never have failed us. What is more, the "bugs" usually encountered in more elaborate circuits have been absent in this setup. This circuit is tried and true and superior to the Tom Thumb crystal oscillator transmitters, which jump out of oscillation when loaded to the antenna and emit a chirpy signal. No trouble will arise from the final trying to take off by itself, either. The plate circuit of the Pierce oscillator is untuned, and since this is effectively the grid circuit of the final, it can't oscillate easily.

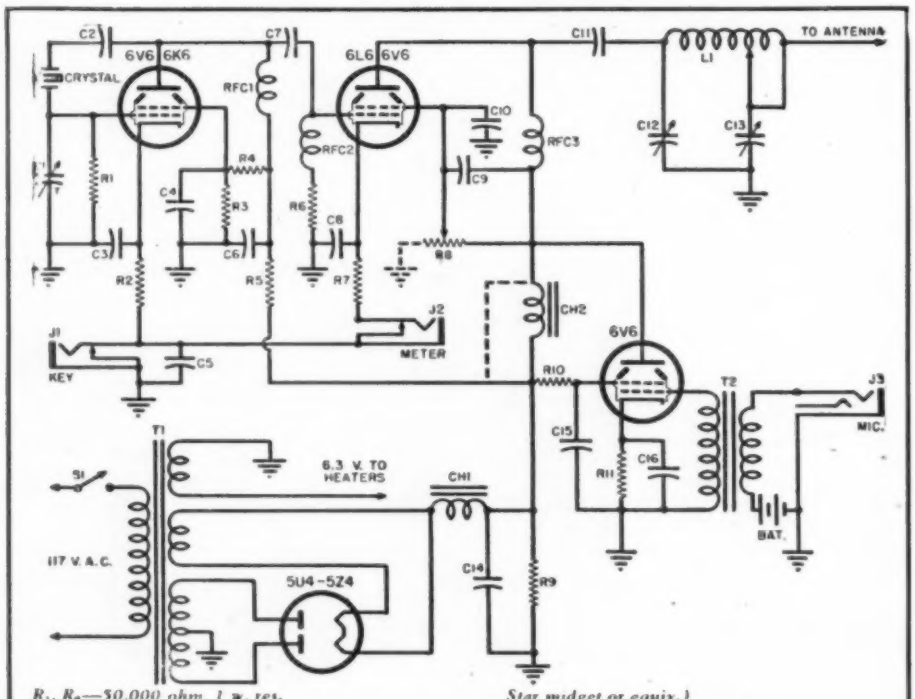
The pi network plate circuit in the final will load to any reasonable length of wire or the tin roof, if you insist. The antenna is part of the plate circuit, and in some instances nearly all of it. You don't have to worry too much about a reactive load with this small power, but it is always best to avoid it. One long-wire antenna we tried required only two turns of the plate coil to resonate. Since a variety of lengths are likely to be used at different locations with a portable rig, we decided to use shunt feed in the plate circuit. This enables the user to make coil adjustments even while the plate voltage is on without danger of getting a shock. This procedure is not recommended however, as it is bad on the tubes and exposes the operator to possible r.f. burns.

Powers of from ten to forty watts input can be used, with slight variations in the dropping resistors and power supply. This particular model was designed for power input of about thirty watts to the 6L6 amplifier, and all values of components should be strictly adhered to, to avoid trouble. However, if you do wish to run different inputs, be sure to vary the power transformer to suit any changes you may make in the dropping resistors and vice versa. Whatever is done in variations, be sure to wind up with about 200 or 250 volts on the plate of the 6K6 Pierce oscillator. More voltage here will put a happy gleam in the eye of your crystal distributor. Also be sure to adjust the amplifier screen grid voltage divider R_8 for 250 volts on the screen, key down conditions.

No attempt was made to read oscillator plate current, crystal current or amplifier grid current. We never would have been able to build it all on the lid of the box had we used all these trimmings. If parts values given are adhered to, it will not be necessary to read these currents.

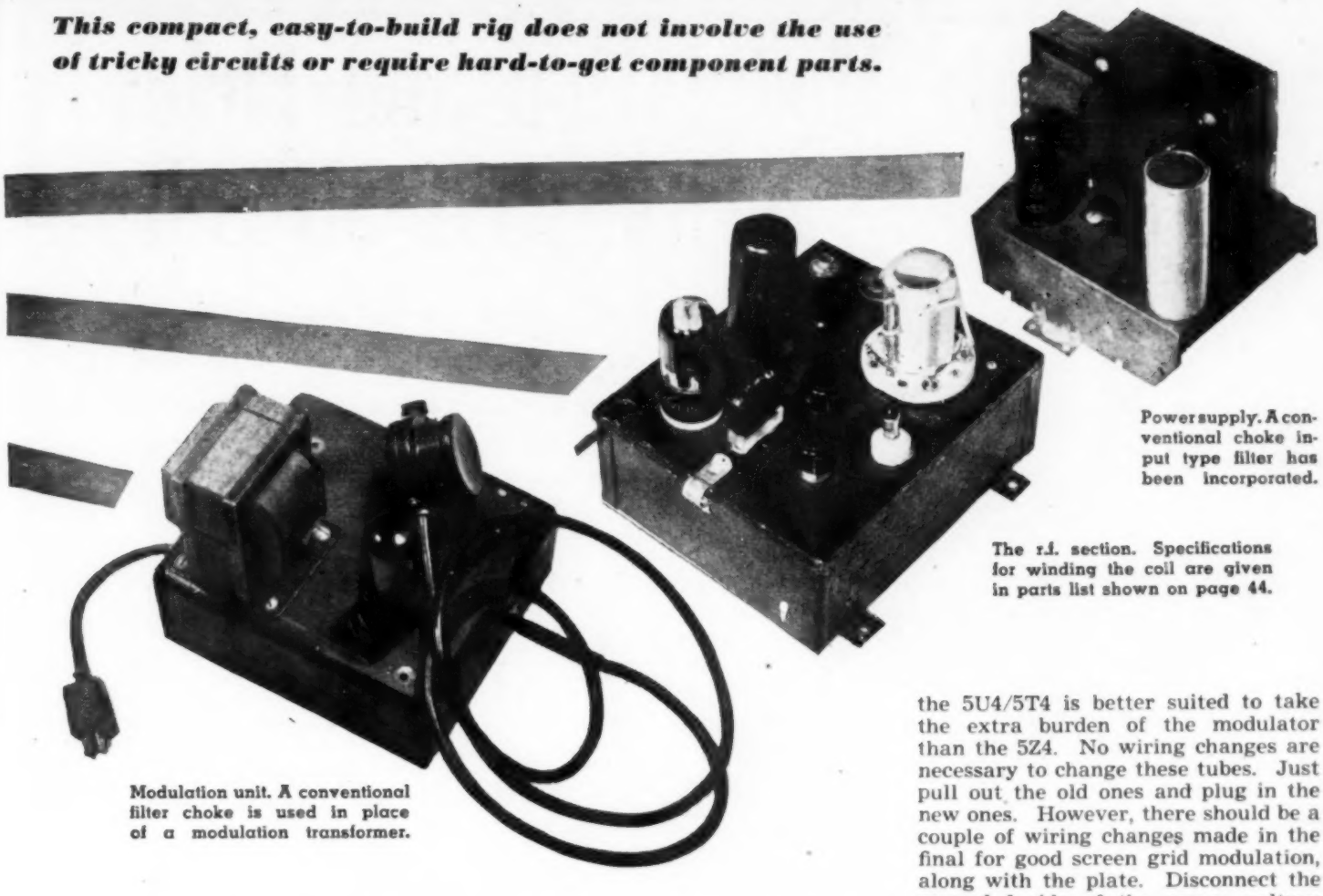
In tuning up, just listen on the receiver for the oscillator and adjust

Circuit diagram of modulated portable rig. Should only c.w. operation be desired the modulator can be eliminated and the necessary r.f. circuit changes incorporated as suggested in the text.



R_1, R_8—30,000 ohm, 1 w. res.
R_2—100 ohm, 2 w. res.
R_3—30,000 ohm, 2 w. res.
R_4—2000 ohm, 2 w. res.
R_5—5000 ohm, 10 w. res.
R_7—250 ohm, 10 w. res.
R_9—25,000 ohm, 25 w. adjustable res.
R_{10}—30,000 ohm, 25 w. res.
R_{11}—20,000 ohm, 10 w. res.
R_{11}—500 ohm, 10 w. res.
C_1—100 μμfd. trimmer
C_2—.01 μfd., 600 v. cond.
C_3, C_4, C_5, C_6, C_9, C_{10}—.002 μfd. mica cond.
C_7—100 μμfd mica cond.
C_8—.005 μfd. mica cond.
C_{11}—.006 μfd., 1000 v. mica cond.
C_{12}, C_{13}—140 μμfd. var. cond. (Hammarlund Star midget or equiv.)
C_{14}—16 μfd., 600 v. elec. cond.
C_{15}—.1 μfd., 600 v. cond.
C_{16}—10 μfd., 50 v. elec. cond.
J_1, J_2—Closed circuit jacks
J_3—3-circuit mike jack
RFC_1, RFC_2, RFC_3—2.5 mh. r.f. choke
L_1—40 t. #16 e., 1½" form, close-wound
CH_1—20 hy., 200 ma. filter choke
CH_2—20 hy., 150 ma. filter choke
S_1—S.p.s.t. toggle sw.
T_1—330-0-330 v. @ 200 ma.; 5 v. @ 2 amp.; 6.3 v. @ 2 amp.
T_2—Single-button mike-to-grid trans. (100: 1 ratio)
1—4½ v. "C" battery
Crystal—See text

This compact, easy-to-build rig does not involve the use of tricky circuits or require hard-to-get component parts.



Power supply. A conventional choke input type filter has been incorporated.

The r.f. section. Specifications for winding the coil are given in parts list shown on page 44.

Modulation unit. A conventional filter choke is used in place of a modulation transformer.

C_1 for optimum operation of the oscillator. Attach antenna and tune the final condenser C_{12} for a dip. It will be necessary to vary the coil turns on L_1 at the same time, in steps. Always begin tuning with the antenna loading condenser C_{13} fully meshed, gradually decreasing this capacity in steps and returning the plate condenser C_{12} each time for a dip. Load to about 75 ma. and you have the green light to go ahead.

Both cathodes are tied together on a common keying jack so that oscillator and amplifier are keyed simultaneously, permitting the use of break-in. The amplifier cathode is also run through another jack for the meter. It is necessary to insulate this jack from the chassis, of course.

If twenty and ten meter operation are desired, it would be better to use series feed in the amplifier plate circuit as shunt fed circuits are not so efficient at the higher frequencies.

If you're not satisfied with just plain c.w., you can add this one tube "Snap On" modulator. This device may be added later, built into the rig to begin with or never built at all, as the reader desires. If used, the modulator may be shelved at any time when only c.w. is used, by making use of a "dummy" Jones plug with shorting arrangement to complete "B" plus to the final.

The modulator consists of a one tube 6V6 class A amplifier of the Heising type. Anyone can get hold of a 20 to 30 henry choke on short notice, but modulation transformers are hard to find. Anyway, this old Heising modulation is plenty good when used with low power beam tubes. Much more explanation of such a simple modulator is unnecessary but a word of caution about the mike circuit. If you use a mike battery as we did, be sure to provide some means of opening the battery circuit when not transmitting. This is taken care of automatically if you use an Army type mike with a PL68 plug and associated 3 way jack, as we did. If this isn't practical in your case, use a separate toggle switch. A small 4½ volt "C" battery will last a long time if so used. Alternately, if you want to sacrifice a little quality, microphone voltage may be taken from the cathode of the modulator tube and adjusted with a suitable dropping resistor. Voltage regulation isn't so good, however.

Now about the changes in the r.f. section of the transmitter. Of course the "B" plus end of the r.f. choke in the plate circuit of the final must be disconnected and the circuit completed through the modulation choke, as shown in the diagram. Then we need to change some tubes. A type 6V6 should be substituted in place of the 6K6 Pierce oscillator to give the final a little more drive for better modulation. Also, substitute a 6V6 in the final in place of the 6L6, and a 5T4 or a 5U4 in the power supply in place of the 5Z4. The 6V6 in the final will lighten the load on the power supply and the 5U4/5T4 is better suited to take the extra burden of the modulator than the 5Z4. No wiring changes are necessary to change these tubes. Just pull out the old ones and plug in the new ones. However, there should be a couple of wiring changes made in the final for good screen grid modulation, along with the plate. Disconnect the grounded side of the screen voltage divider, R_8 and connect a .005 μfd., 600 volt condenser C_9 across this resistor, as shown in the schematic. Readjust R_8 for 250 volts on the screen with carrier on.

A point often overlooked in the use of beam power tubes is the correct amount of screen grid voltage. If the voltage is too high, the familiar sign of climbing plate current caused by secondary emission from the screen will be noticed, along with overheating of the grid.

If the screen voltage is too low, the power output will suffer, and it will not be possible to load the stage to full output.

The amount of grid drive will affect the screen current, and in turn the voltage on the screen. The proper excitation should be applied to the grid of the tube when the adjustment of the screen resistor R_8 is made. This will insure operation under optimum conditions for maximum performance.

Of course all these changes could have been incorporated in the rig to begin with, and should be made initially if the reader is sure he wants to modulate the rig at the start. Power output is reduced on the order of 5 to 10 watts by the changes, however, so for that reason the strictly c.w. men would prefer the c.w. version. Note that it is unnecessary to connect anything to the tip terminal on the mike jack. Switching is done internally in the Army mike.

-30-

A Simple Modulation and Field STRENGTH METER

Construction details for a self-contained test instrument. By using crystal detectors power supplies and batteries are eliminated.

Fig. 1. The completed meter in its case. The knob on the left switches the meter from r.f. to read positive or negative peaks.

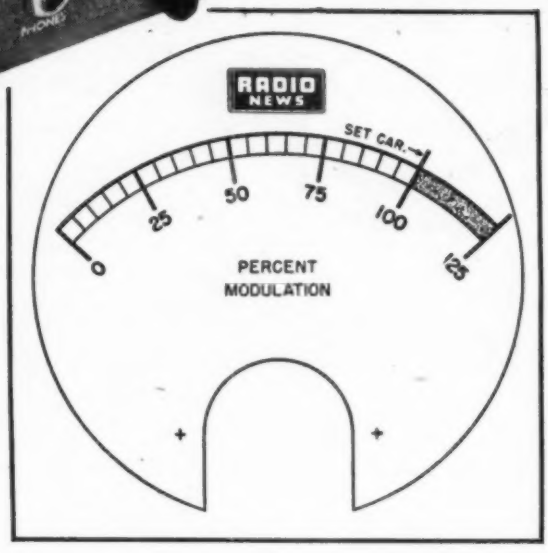


Fig. 2. Full-sized scale which may be pasted over the face of any standard 3¼" meter dial.

By

RAY FRANK, W9JU
Amateur Radio Editor,
RADIO NEWS

THE advent of the new crystal diodes has opened a new field for a variety of test equipment of a portable nature. The elimination of the usual heater or filament supply aids materially. In addition, the bugaboo of batteries that always require replacement just when the instrument is needed most, is avoided.

Two pieces of equipment of maximum usefulness around the ham shack are, a field strength meter, and a modulation meter. The field strength meter permits antennas to be adjusted for maximum efficiency, or can do yeoman duty as a neutralization indicator. The modulation meter allows the transmitter to be operated at high modulation levels without fear of overmodulation.

Both pieces of equipment may be combined into a single unit by the use of a 0-1 ma. meter, and two 1N34 crystal diodes. One diode serves to rectify the carrier so that it may be read on the meter. When modulation is to be checked, the second diode rectifies the audio component of the carrier, and allows the modulation percentage to be measured by means of the meter. A reversing switch allows either positive or negative peaks to be checked. The schematic of the instrument is given in Fig. 3.

An examination of the circuit shown in Fig. 3 will indicate the operation of the meter. When the ganged switch, S_1, is in the upper position, the meter is connected across the output of the carrier rectifier circuit formed by the rectifier and R_1. A multiplier resistor, R_2, is placed in series with the meter to increase the range of the meter. The r.f. is filtered from the circuit by means of an r.f. filter network composed of RFC_1 and C_4.

As the switch is thrown to the center position, the audio output of the carrier rectifier is applied to the primary of the transformer, T_1. The purpose of this transformer is to enable an impedance match to be obtained between the low impedance secondary load and the carrier rectifier output.

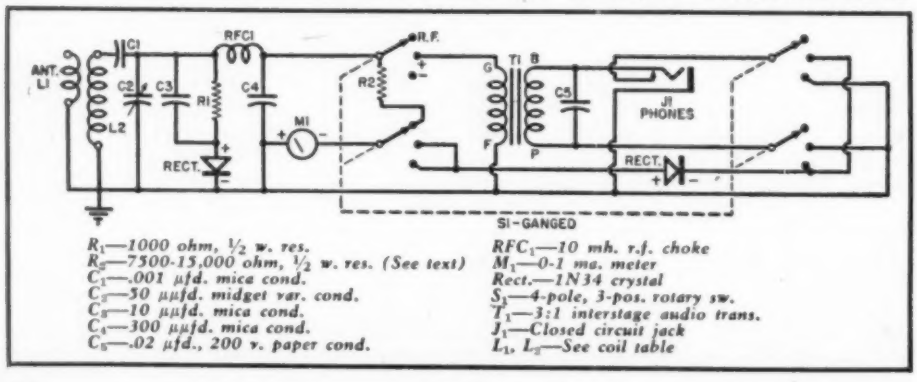
The output of this transformer is fed either to the headphones, when they are inserted, or to the second rectifier circuit. This rectifier circuit consists of a crystal diode in series with the meter.

The condenser, C_5, across the output winding of T_1 stores audio energy, and enables the meter to give a true picture of the average modulation, rather than the transient peaks.

In the third or lower position of the switch, the action is the same as the center position, with the exception that the output of the transformer, T_1, is reversed, at the same time the meter connections are reversed. In this manner the lower or negative portion of

(*Continued on page* 96)

Fig. 3. Schematic diagram of the meter which uses a four-pole, three-position switch.



R_1—1000 ohm, ½ w. res.
R_2—7500-15,000 ohm, ½ w. res. (See text)
C_1—.001 μfd. mica cond.
C_2—50 μμfd. midget var. cond.
C_3—10 μμfd. mica cond.
C_4—300 μμfd. mica cond.
C_5—.02 μfd., 200 v. paper cond.
RFC_1—10 mh. r.f. choke
M_1—0-1 ma. meter
Rect.—1N34 crystal
S_1—4-pole, 3-pos. rotary sw.
T_1—3:1 interstage audio trans.
J_1—Closed circuit jack
L_1, L_2—See coil table

High Fidelity MINIATURE TUBE RECEIVER

By J. CARLISLE HOADLEY

Applying the new miniature tubes to the construction of a t.r.f. receiver and a dual-input audio amplifier.

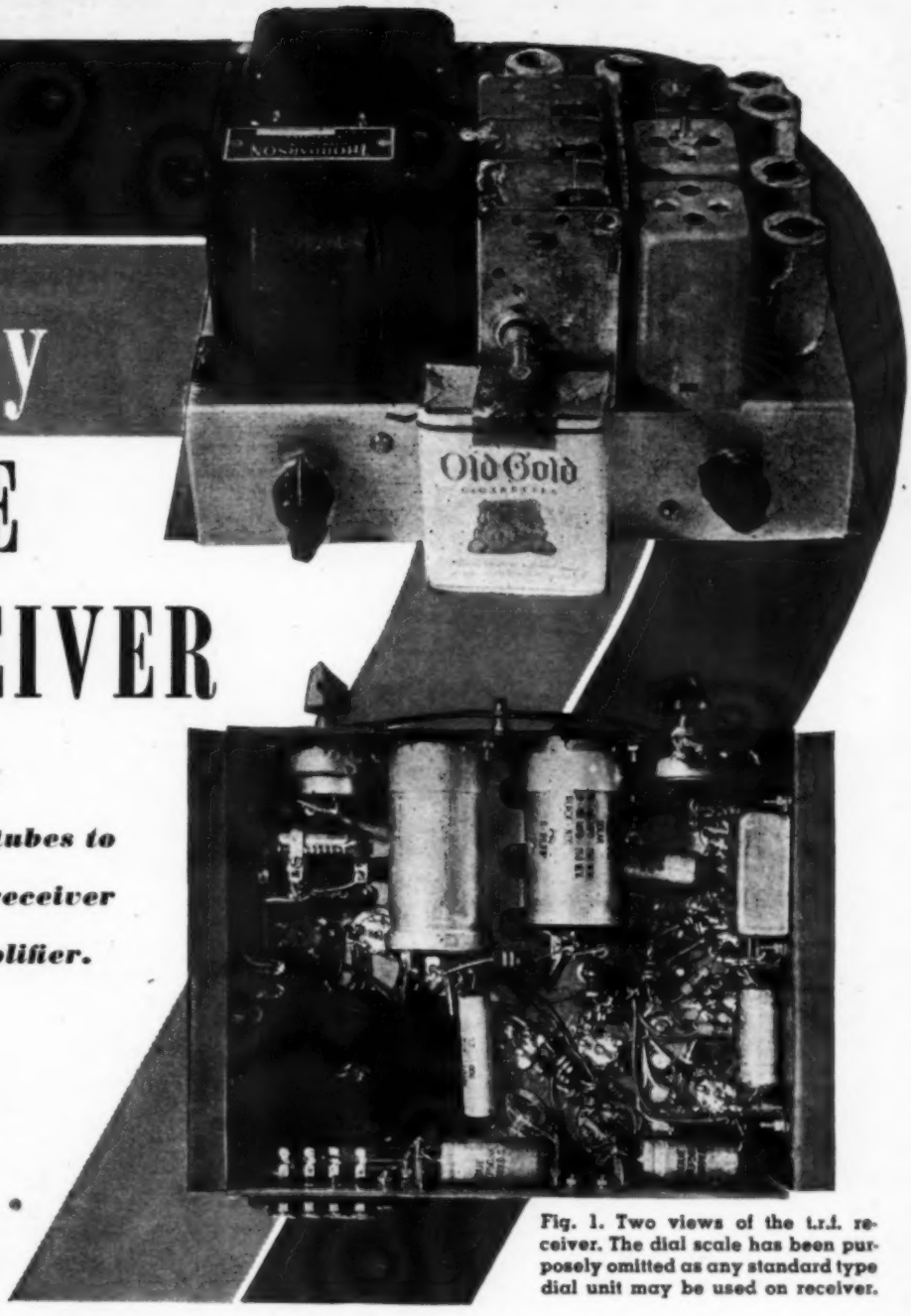


Fig. 1. Two views of the t.r.f. receiver. The dial scale has been purposely omitted as any standard type dial unit may be used on receiver.

DURING the war, the development of the miniature tube series was accelerated to the point where we now have a complete complement of these small wonders. We may even select from among several for most tube functions. These small brothers of the metal and GT series of tubes are quite capable, and are not only able to equal in performance their big counterparts, but, in most cases, produce superior results.

In general, the miniature tubes produce the same amplification with equal or less power input, and their input and output capacities are less. They are physically smaller, allowing shorter leads, which means more gain at higher frequencies and less tendency toward oscillation at lower frequencies.

Let us consider the design and construction of a broadcast receiver using these new super midgets. A t.r.f. circuit was chosen because it is simple to build and yields superb quality on local reception. It is broad enough to provide broadband high fidelity reception, and sensitive enough to provide good reception up to 50 or 75 miles. Its selectivity is sufficient to separate the local stations in any large city.

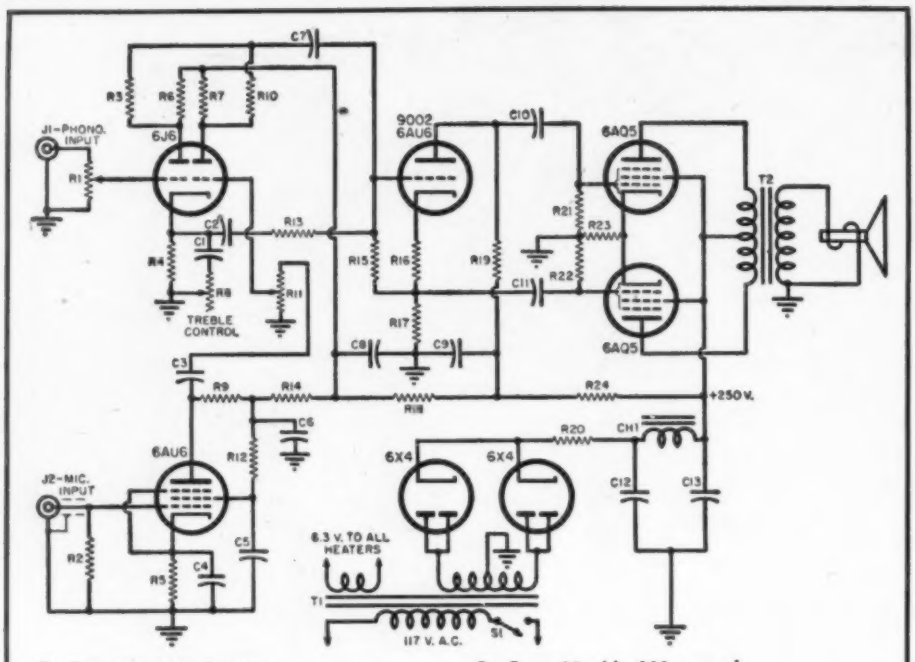
The line-up was chosen as follows; two stages of tuned radio frequency amplification, using remote cutoff pentodes; a tuned triode infinite impedance detector; diode a.v.c. rectifier; a stage of triode audio amplication; a triode phase inverter; and push-pull pentode output stage.

For the radio frequency amplifier, we have a choice between the 9003 and the 6BD6. Both are remote cutoff pentode amplifiers and the latter is equal, roughly, to the 6SK7 in characteristics. We could choose several other higher gain tubes, but they are unnecessary and their tendency toward oscillation is too great. In the interest of maximum sensitivity, we might have chosen the 6AK5 which has a mutual conductance of twice that of the 6BD6 and, by using a series connected screen resistor, imparted to it semiremote cutoff characteristics.

For the detector we have several choices but a 6AU6 sharp cutoff pentode, triode connected, was chosen. This tube is quite similar to the 6SJ7. For the a.v.c. rectifier, we may use the 6AL5 which is a dual diode similar to the 6H6, except that it has a higher current rating. We could also have utilized the diode section of a 6AQ6 duplex diode, high mu triode.

For the first audio amplifier, we used a 9002, although a triode connected 6AU6 or 6AK5 might have been used. The 9002, however, draws only 150 milliamperes at 6.3 volts for its heater, which is quite economical. The phase inverter is also a 9002, although it might have been the triode section of a 6AQ6, a triode connected 6AU6 or a triode connected 6AK5. The 6AQ6 would yield the highest gain, which would be in the order of 70 times.

A cathode follower type inverter was chosen because of its low distortion, due to inherent degeneration. For output tubes, we chose the new 6AQ5 power pentodes in push-pull. These tubes are exact electrical duplicates of a 6V6 with the restriction that the maximum plate voltage is 250 volts.



R_1, R_{11}—500,000 ohm pot.
R_2—1 megohm, ½ w. res.
R_3, R_6, R_7, R_{10}, R_{17}, R_{19}—47,000 ohm, ½ w. res.
R_4—1500 ohm, ½ w. res.
R_5—3000 ohm, ½ w. res.
R_8—10,000 ohm rheostat
R_9—330,000 ohm, ½ w. res.
R_{12}—1.5 megohm, ½ w. res.
R_{13}—270,000 ohm, ½ w. res.
R_{14}—100,000 ohm, ½ w. res.
R_{15}, R_{21}, R_{22}—470,000 ohm, ½ w. res.
R_{16}—2200 ohm, ½ w. res.
R_{18}—13,000 ohm, 1 w. res.
R_{20}—Adjust for 250 v. d.c. output
R_{23}—300 ohm, 10 w. res.
C_1, C_{11}—.05 μfd., 200 v. cond.
C_2—.02 μfd., 200 v. cond.
C_3, C_7, C_{10}—.05 μfd., 400 v. cond.
C_4—10 μfd., 25 v. elec. cond.
C_5—10 μfd., 250 v. elec. cond.
C_6, C_8—40 μfd., 250 v. elec. cond.
C_9, C_{12}, C_{13}—20 μfd., 300 v. elec. cond.
J_1, J_2—Phono-mike jacks
S_1—S.p.s.t. sw.
T_1—Power trans. 300 v. d.c. @ 100 ma.; 6.3 v. @ 3 amps.
T_2—Output trans. 10,000 ohm plate-to-plate to v.c.
CH_1—8 hy., 100 ma. filter choke
Speaker—PM type (any size)

Fig. 2. Schematic diagram of an audio amplifier that has been designed around the new miniature tubes. By using push-pull 6AQ5 tubes, an output of 10 watts is obtained.

At this plate voltage, two of these tubes will yield 10 watts of power at only five per-cent distortion.

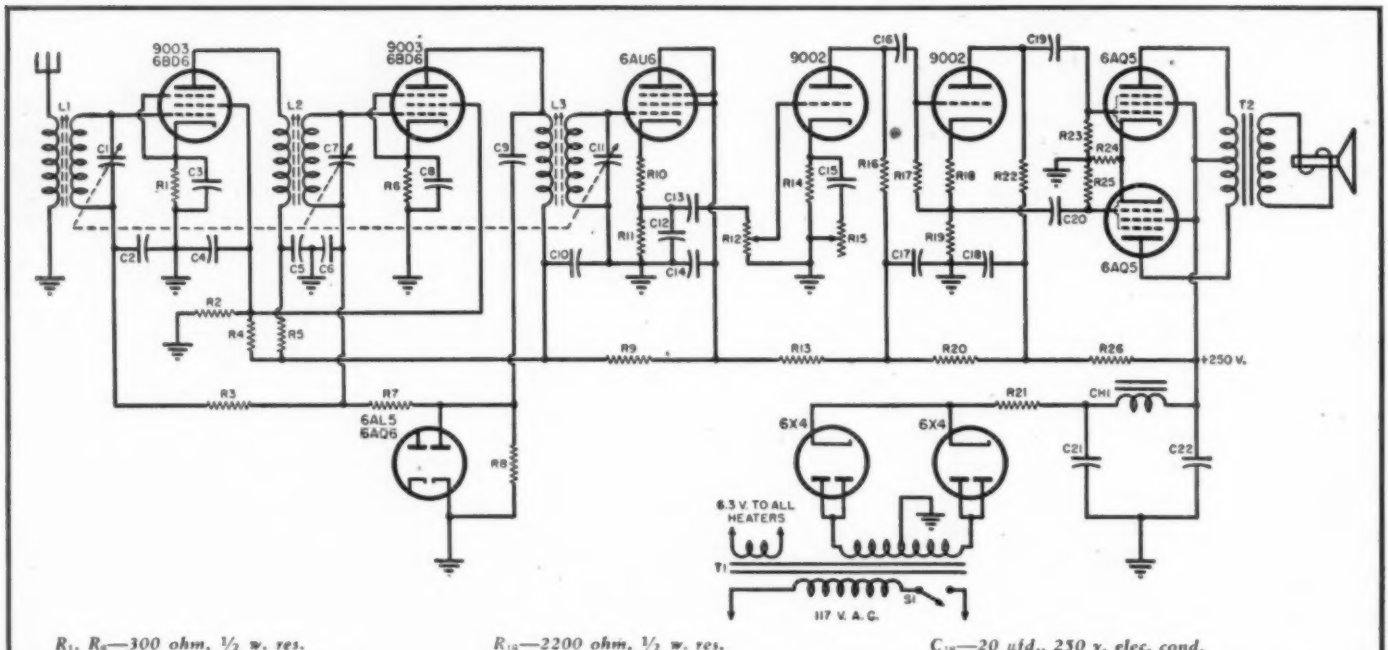
If we wished to economize on our power supply, we might use push-pull 6AK6 tubes which would yield about four watts output while drawing but 40 milliamperes total plate current.

The choice of a rectifier was limited to the 6X4 tube which is an electrical duplicate of the 6X5. As our 6AQ5 output tubes will draw 80 ma. at ten watts output, and the 6X4 will deliver only 75 ma., it was necessary to use two 6X4 tubes for the power supply. If one 6AQ5 output tube, or push-pull 6AK6's, had been decided upon, then one 6X4 would have been adequate. The single 6AQ5 will deliver 4.5 watts at 8 per-cent total distortion. A 90 ma. power transformer, with a 6.3 volt winding that would deliver 3 amperes, was chosen. The 5 volt winding was not used.

The chassis for our receiver was built from an aluminum cookie sheet. Be sure that you get one made of soft aluminum. Some of the harder alloys will not bend without breaking. The finished chassis was 6½ inches by 8 inches by 2 inches, which is unbelievably small compared to a chassis for a conventional 10 tube receiver.

The coils are slug-tuned iron core *Meissner* units which provide exceptional gain and the ability to adjust the inductance at the low frequency end of the dial. Trimmers are provided for aligning the high frequency end of the dial. This yields consistently high amplification over the entire tun-

Fig. 3. Schematic diagram of t.r.f. receiver. Complete details for building a bass-reflex cabinet are given in Fig. 4.



R_1, R_6—300 ohm, ½ w. res.
R_2, R_{13}, R_{20}—13,000 ohm, ½ w. res.
R_3—270,000 ohm, ½ w. res.
R_4, R_{10}, R_{11}—33,000 ohm, ½ w. res.
R_5—3600 ohm, ½ w. res.
R_7, R_8, R_{22}, R_{25}—470,000 ohm, ½ w. res.
R_9—18,000 ohm, ½ w. res.
R_{12}—500,000 ohm pot.
R_{14}—5100 ohm, ½ w. res.
R_{15}—10,000 ohm, rheostat
R_{16}—51,000 ohm, ½ w. res.
R_{17}—510,000 ohm, ½ w. res.
R_{18}—2200 ohm, ½ w. res.
R_{19}, R_{26}—47,000 ohm, ½ w. res.
R_{21}—500-1000 ohm (adjust so that output is 250 v. d.c.)
R_{24}—300 ohm, 10 w. res.
C_1, C_7, C_{11}—3-gang, 363 μμfd./sec. var. cond.
C_2, C_3, C_8, C_9, C_{10}—.1 μfd., 200 v. cond.
C_4, C_5—.1 μfd., 400 v. cond.
C_6, C_{12}—31 μμfd. mica cond.
C_{13}, C_{15}, C_{20}—.05 μfd., 200 v. cond.
C_{14}, C_{17}—40 μfd., 250 v. elec. cond.
C_{16}, C_{19}—.05 μfd., 400 v. cond.
C_{18}—20 μfd., 250 v. elec. cond.
C_{21}, C_{22}—20 μfd., 300 v. elec. cond.
L_1—Ant. coil (Meissner 14-7413 or equiv.)
L_2—R.f. coil (Meissner 14-7358 or equiv.)
L_3—Det. coil (Meissner 14-7358 or equiv.)
T_1—Power trans. 300 v. d.c. @ 100 ma.; 6.3 v. @ 3 amps.
T_2—Output trans. 10,000 ohm plate-to-plate to v.c.
CH_1—8 hy., 90 ma. filter choke
S_1—S.p.s.t. sw. (on R_{15})
Speaker—PM type (any size)

ing range. It is interesting to note that the tuning range of the receiver is wider than normal, due to the low input capacities of the r.f. tubes, and will tune from 550 kc. to about 1800 kc., so that police stations may also be tuned in.

The layout is such that the shortest leads possible are obtained, and the three-gang condenser, the coils, and the tubes are side by side. A lot of space was saved, and attendant underchassis confusion eliminated by the use of triple 0.1 μfd. can-type bypass condensers which were mounted in convenient places. The tube sockets are of the shielded type and are ceramic. The electrolytic filter condensers were mounted underneath the three-gang condenser in a space that would have been otherwise wasted. *Ceramicon* condensers were used for all small values, although micas would have been as good electrically, but not as small physically.

The choke was mounted on top of the chassis. If a field type speaker of 1000 ohms is used, the choke will be eliminated and the output transformer may be mounted in its place. If a PM type speaker is used, the choke may be mounted as shown, and the output transformer mounted on the speaker. The coupling condensers are mounted on small mounting strips so that they are mechanically solid. Most of the resistors are wired point-to-point and are of the small ½ watt type. There are several small 1 watt resistors which are also soldered point-to-point.

The grounds are provided by the little mounting rings for the seven pin miniature sockets. The little semicircular mounting rings are tapped to receive two 4-40 screws to mount the sockets, and have a grounding lug which is conveniently located where the eighth pin would be in the seven pin socket. The heater pin and the shield in the center of the socket, together with the other circuit grounds, can be made to it conveniently.

It might be noted that most power transformers have an output voltage which was chosen for use with the larger tubes and is, consequently, higher than necessary or advisable with the miniatures. The maximum plate voltage on the miniatures is +250 volts, so if your power supply voltage is too high, it will be necessary to insert a resistor, as we have done, to reduce the voltage to the filter system, or a higher resistance speaker field may be used as a choke. The latter is particularly desirable, as it provides better filtering with resultant low hum and it will allow more power dissipation in the speaker field, thus permitting the use of a larger speaker.

Remember that the power output of this little receiver is comparable to the larger console radios and will drive a heavy-duty twelve or fifteen inch speaker. The speaker should be adequately baffled, preferably in a bass reflex enclosure. A table of baffle sizes for different speakers is given in Fig. 4.

It will be found that ordinary hook-up wire will seem large and clumsy, and it is recommended that you use some of the new small acetate or synthetic rubber insulated wire. B & S gauge 22 may be used. This wire has adequate breakdown ratings and is much smaller physically than the older type.

A connection is brought out to connect a phono-pickup so that the audio system may be used to play phonograph records.

A tone control of the degeneration type is included so that the high frequencies may be controlled. This is particularly necessary, as the higher frequencies will be very brilliant with a wide band t.r.f. tuner. The bass is full and natural, particularly on organ music where the advantages of the distortionless infinite impedance detector will be immediately apparent. The wiring diagram is seen in Fig. 3.

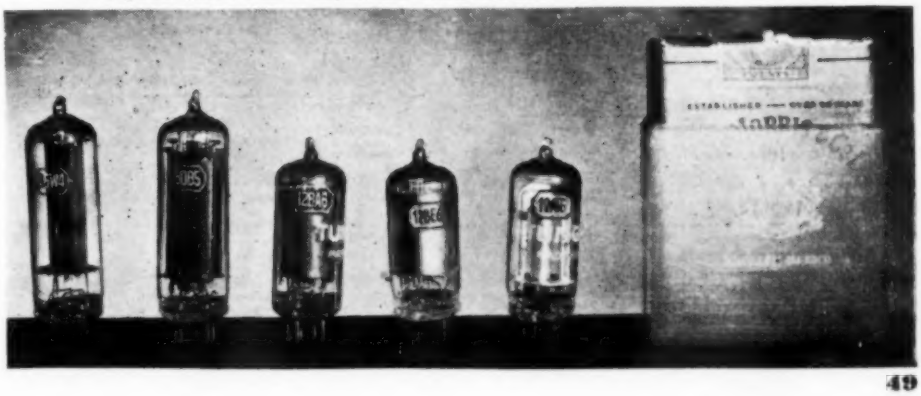
When the wiring job is finished, the receiver is aligned. An advantage of the t.r.f. type receiver is that it can be accurately aligned by ear. Vary the slug tuning screws on the coils until maximum volume is obtained on a station around 600 kc. Next, tune to a station around 1500 kc. and adjust the trimmers for maximum volume, then go back to the 600 kc. station and readjust the slugs. Do this several times until they are both at maximum. The receiver should now have uniform gain over the entire dial. Because of the a.v.c., it is desirable to align the receiver on weak stations or with a short antenna.

This receiver does not require much in the way of an antenna. Ten or fifteen feet of wire is quite sufficient for reception of local stations. For maximum sensitivity in remote sections, a long antenna may be used. It will be found that this receiver will be much quieter than a superheterodyne and will not have the usual hiss which appears on a weak station in a superheterodyne.

If much greater sensitivity is desired, the receiver may be easily wired

(*Continued on page* 170)

The evolution of the receiving type vacuum tube is clearly indicated in this picture. Within the last few years tube sizes have been reduced materially yet their performance has not been impaired, in fact, in many cases, these smaller tubes give better results than do the equivalent tubes of larger sizes.



These receiving type tubes will comprise the new five-tube a.c.-d.c. kit. As soon as production permits, most of the table model, a.c.-d.c. type home receivers will be designed around these tubes. These tubes will be used to replace (from left to right) the 35Z5, 50L6, 12SK7, 12SA7 and the 12SQ7.

THE RECORDING and REPRODUCTION of SOUND

Fig. 1. Hand cranked, governor controlled Victrola of the year 1898.

By
OLIVER READ
Editor, RADIO NEWS

Part 2. The history of "acoustical" recording machines and the transition to our present-day so-called "electrical" recording heads of the capacitive, magnetic, and crystal types.

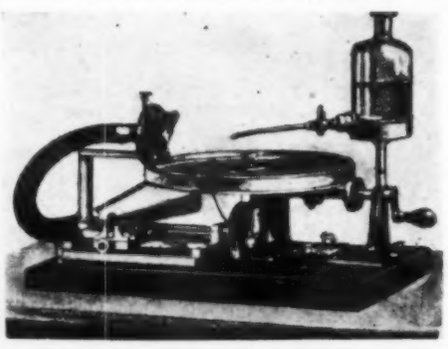
THE great American inventor *Thomas Edison,* back in 1877, stumbled across what was to become the first recording and reproducing system. Edison used an *acoustical* method for recording and reproducing sound on a wax roll. Commercial use was not found for this invention until several years later when the *Ediphone,* a business dictating machine was developed. Correspondence and other intelligence could be recorded on this unit and later transcribed from the wax cylinders. The early models utilized cylinders which could be used only once, but later ones were developed with a very thick coating of wax so that previous sounds could be scraped from the surface and the new surface reused.

The record industry had its origin in 1855 with Leon Scott's "Phonautograph." This was not a practical means for recording or reproducing sound as about all this machine could do was to trace grooves in lampblack.

The granddaddy of the present *Dictaphone* (shown in Fig. 3) machines was invented by *Alexander Graham Bell* and two associates in 1881. His machine employed a heavy metal casting to which was mounted a heavy steel rod, part of which acted as a "feed screw" to move the acoustical diaphragm in a horizontal plane. A wax coated cylinder was also mounted to the shaft which, on Bell's invention, was hand-driven by a crank. This historic machine was removed from its vault in the Smithsonian Institute on October 27, 1937 where it had remained for 56 years. The wax cylinder when replayed revealed the following:

"The following words and sounds

Fig. 2. Berliner's original machine which featured the use of wax disc.



are recorded upon the cylinder of the gramophone . . . tra tra . . . There are more things in Heaven and earth, Horatio, than are dreamed of in our philosophy . . . trr . . . I am a gramophone and my mother was a phonograph."

Later in 1885 the Volta Laboratories, controlled by Alexander Graham Bell, began filing new patents to make the invention commercially successful. The *American Gramophone Company* was organized in order to serve a market for these machines. Edison then began to exploit his machine commercially.[1]

There were a few patent difficulties between Edison and Volta. However, when these were worked out, they became very friendly competitors in this new field.

Emil Berliner then came into the picture and to him goes credit for the records and phonographs we use today. Berliner devised a means for recording on and reproducing sound from a flat disc. (Fig. 2.) Furthermore, he developed a means for pressing (making copies) records from a master, rather than taking a chance of ruining the original disc, as was done by Edison and Volta. Berliner later became connected with a Camden machinist by the name of *Eldridge Johnson.* Johnson contributed many improvements to the original Berliner machine.

The Edison and Bell machines both worked on the same fundamental principle. In both cases, the waves set up in the air by any source of sound were allowed to strike a delicately held diaphragm which vibrated under the impact of the sound waves. The only difference was in the method of re-

[1] Walker, Frank B. RADIO AGE, January 1942.

cording the sound on the rotating cylinder. In the Edison invention, the record was produced by indenting a line of varying radial depth, while Bell obtained the record by actually cutting the line on a blank cylinder. In both cases the vibrating diaphragm was made to produce a sound line of varying depth on the surface of the record.

Berliner, in 1890, took out patents for further improvements in the Gramophone. In particular were new forms of diaphragm holders or sound boxes. One was designed for recording purposes and the other for reproducing. Even then the Gramophone had not become a commercial article. It was near the end of 1897 that the first disc record was manufactured commercially in the United States. This made the Gramophone popular as a means for entertainment. Instead of a record being made from an etched metal original, a disc record made by a new process which allowed many hundreds of good facsimile copies to be made from the one master record could be offered to the public. The process consisted of cutting the first record on a disc-shaped blank of a wax-like material. Later a solid metal negative was made by electro-deposition. Then followed the pressing of copies of the original from this negative in a material which was hard at normal temperatures but became plastic under heat.

The period that followed was devoted by several inventors to mechanical improvements for the machine. An efficient governor, or speed regulator, was provided to insure a uniform speed of rotation of the turntable. The hand-driven machine was abolished and a new machine which was driven by a spring motor substituted. The speed regulator was furnished with an indicator that showed the speed when the machine was running so that the records, on reproduction, could be revolved at exactly the same speed as the blank on which the original record was cut.

The sound box also went through a series of improvements, the inventors' object being to render the diaphragm as sensitive as possible, either to the sound waves of the selection being recorded or to the vibrations transmitted to it from the record disc, as the case might be. Other improvements were made in the means of conveying the sounds recreated in the sound box to the ear of the auditor. The old air tube had disappeared to give place to a small horn. The sound box was attached to the narrow end. The next step was to remove the amplifying horn a short distance from the sound box and to carry it upon a rigid bracket on the cabinet of the instrument. The sound box was connected to the small end of the horn by a piece of flexible tubing which allowed the sound box to move across the turntable and also to be raised or lowered above the record. Patents were taken out in 1903 to replace this piece of tubing with a paper arm. A joint in the amplifying horn itself was also added. The idea was that while the horn could be located immediately next to the sound box, the latter could be moved with freedom without moving the heavy bell portion of the amplifying horn. The success of this invention was immediate and a tapering sound arm was adopted.

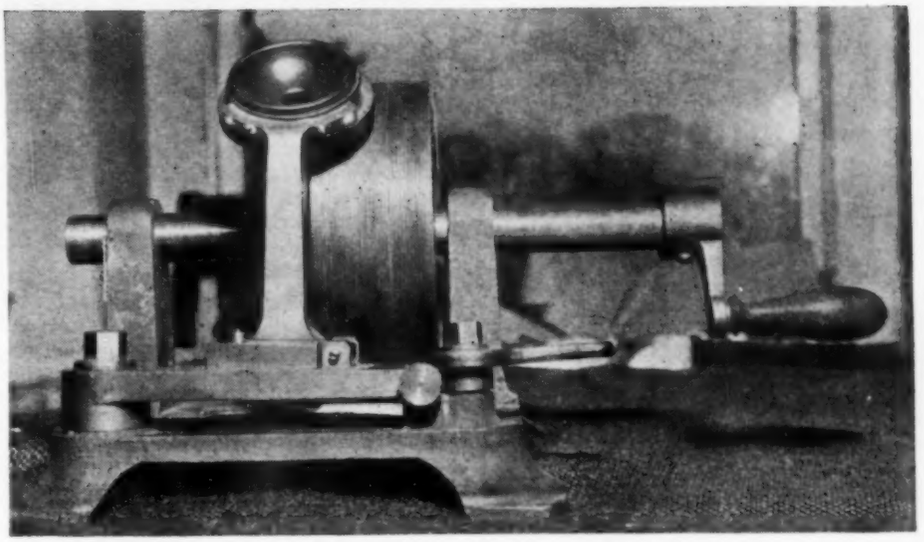


Fig. 3. The original Bell Gramaphone (1881) now in the Smithsonian Institute.

The Auxetophone

Sir Charles Parsons, English inventor, did much development work on the Gramophone. He perfected means for intensifying the sound by using air valves. Improvements in sound reproducers or intensifiers (as they were then called) applicable to phonographs, Gramophones, telephones, etc., were replaced by Parsons with the well-known mica diaphragm and by a very finely adjusted valve which controlled the flow of a column of air supplied under pressure. (Fig. 4). The action of Parsons' invention which he called the *Auxetophone,* was as follows: As the needle followed the sinuosities of the sound line on the record, the valve moved with it and this opened and closed the slots in the valve seat through which the air was rushing. The air was therefore given minute pulsations corresponding to the undulations in the sound record so

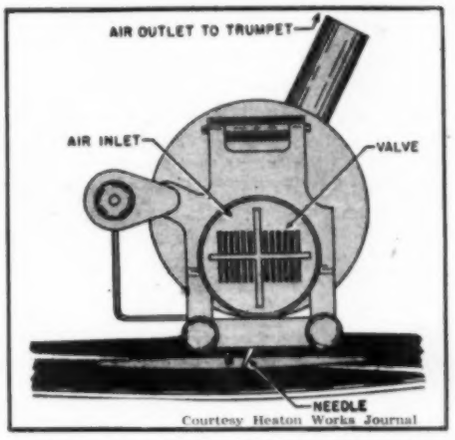


Fig. 4. Construction details of Parson's Auxetophone designed for intensifying sound by means of air pressure.

Fig. 5. Horn-style Victrola which was introduced to the public in the year 1902.

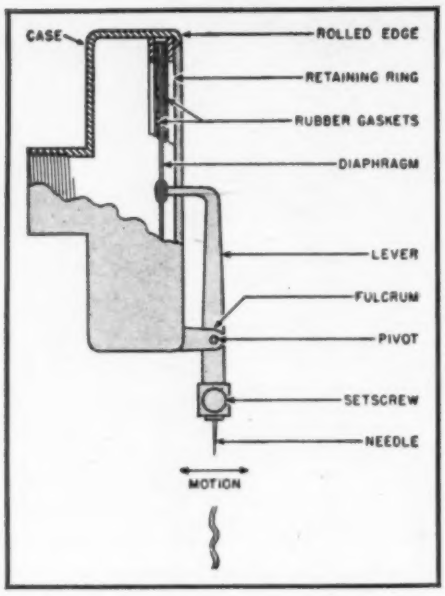


Fig. 6. Construction of an acoustical reproducer used with early phonographs.

that sound waves identical with those originally recorded were set up in the surrounding air and travelled to the ear of the hearer. The valve was mounted on a weigh bar rigidly connected to the reproducing stylus bar or needle holder. This weigh bar was capable of oscillating rotationally only about its own axis. A box containing a filter was also provided to insure that the air, before entering the valve, was perfectly clean. Very fine adjustments of the valve would be unbalanced if particles of dust or oil got into the unit.

Later patents taken out by Parsons related to musical instruments. Patents described the use of a valve as adapted to stringed instruments such as a violin, violoncello, bass, double bass, pianoforte, harp, etc. He replaced the usual sounding board or membrane by a valve operated directly by the vibrations of the strings. The valve was substantially the same as previously described and, as applied to a violin, was supported from a structure on which the bridge was carried, the sounding board being removed. On the exit side of the valve an expanding trumpet was provided and this was lined with velvet which had the effect of damping out any scratching sounds and very high harmonics.

Parsons' further contributions to the art included means for attaching Gramophone needles to the sound reproducer. He made the hole for the needle diamond shaped so that when in use the needle seated itself in the hole by the pressure between the socket and the record. To retain the needle in position when the reproducer was not resting on the record he provided a small magnet with its poles sufficiently near the needle to keep it in a slanting position. Alternatively, instead of using a magnet, a very light spring attached to the socket arm was used pressing lightly against the needle to keep it from falling out.

Parsons took out other patents that contributed further to improvement of sound quality. One of these patents covered the use of an elastic connection joining the needle and the moving part of the valve. The object of this invention was to provide means whereby scratching sounds and changes of tone were reduced or eliminated. A better and more uniform reproduction of the original sound resulted. He also took out a patent covering the use of a compensating cylinder and piston which rendered the working position of the valve independent of fluctuations of air pressure. It was found that the mean position of the valves was disturbed by differences or fluctuations of air pressure from the supply with the result that the tone or power of the instrument was thereby affected.[2]

The *Victor Talking Machine Company* was formed in 1898. One of the earliest of all the *Victrolas* is shown in Fig. 1. This was the old-fashioned acoustical horn style phonograph so familiar to many of our parents and grandparents.

It should be remembered that all of the previous instruments described are essentially acoustical in operation. They relied almost entirely upon sound pressure, or pressure striking a diaphragm, (Fig. 6) and actuating a needle or other device. A typical recording setup of an orchestra making an acoustical record is shown in Fig. 7. Here we see that the musicians are literally crowded in front of a long horn. The weaker instruments, those having the lowest amplitudes of sound, were placed forward, while those possessing greater power, volume or amplitude were placed further to the rear. The idea was for the musicians to play as loud as possible in order that the greatest possible volume would enter the horn.

At the smallest terminating point of the horn was stretched a diaphragm in a framework. The diaphragm picked up the sound pressure waves coming into the horn from the instruments of the orchestra and the sound waves were modulated onto the master record of wax (Fig. 8). A reversed process was used for playback.

While the literature does not disclose why the standard speed of 78 r.p.m. was chosen for the phonograph industry, apparently this just happened to be the speed created by one of the early machines and, for no other reason continued to be used. In those early days speed was an important factor in getting satisfactory quality from the records. The phonograph turntable had to revolve at considerable speed in order that the high notes (and there were few in those days) could be reproduced, a process which will be explained in later articles. Finished records were reproduced by means of another horn connected to a diaphragm to which was fastened the reproducing needle. Sound waves appearing in the grooves of the record would move the needle from side to side and thus transmit vibrations to the diaphragm as shown in Fig. 6. Sound waves would then pass through the horn and be amplified somewhat by the "focusing effect" of the horn.

Thus, we have the earliest acoustical recording and reproducing systems. Today, as we all know, electronics plays a dominant part in the recording and reproduction of sound. The fundamentals, however, remain basically the same. Undulations in recorded grooves are transformed into electrical vibrations which are amplified by means of suitable amplifying equipment and reproduced through modern speaker systems.

[2] Heaton Works Journal, Dec. 1934—p. 251.

Fig. 7. Rosario Bourdon and the Victor Salon Orchestra recording in the early '20's.

Electrical Recording

Electrical recording was borrowed from the radio, the microphone and the vacuum tube amplifier which had, by 1927, supplanted the old method of singing, talking or playing directly into a horn. This latter system depended upon the sound wave pressure

(*Continued on page* 149)

DIRECTIONAL PATTERNS with a 54A Array

By H. R. WHALEY
Western Electric Company

This FM antenna is versatile in that its radiation patterns can be varied to best cover its required service area.

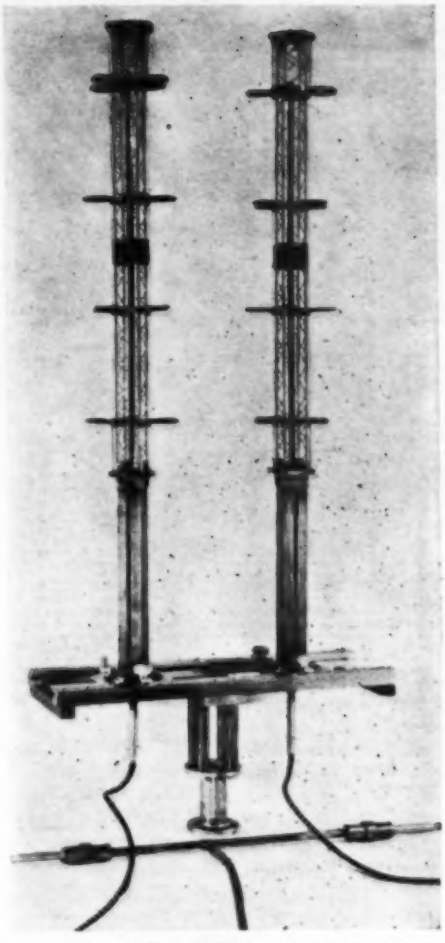


Fig. 1. The 54A FM antenna array.

USUALLY a requirement for FM antennas is that they radiate energy uniformly in all horizontal directions. A circular radiation pattern in the horizontal plane was, therefore, one of the design objectives in the development of the *Western Electric* 54A antenna. Its uniform horizontal plane radiation characteristic is highly desirable when the antenna is to be located at or near the center of the proposed service area.

Should the occasion arise, however, when horizontal directivity would be desirable, the light, rugged and inexpensive 54A can be used advantageously. Seacoast cities or those in hilly or mountainous areas, for example, might find it suitable when the FM transmitter is located near one side of the desired service area.

While the problem of designing antennas to meet specific requirements in directivity is not new, it is complicated at best. Usually the most successful designs will be found to be the most simple. In addition to desirable mechanical characteristics, the circular horizontal radiation pattern makes the 54A antenna particularly useful as a directive array element.

Suitable control of space relationship between two radiators and of the phase relationship between the currents in them gives the array designer a large variety of radiation patterns. Two useful patterns are shown here as illustrations. The data from which the curves were plotted were taken from accurate 1/10 scale models.

The Models

In order to secure any one of the many possible patterns, it is necessary, in general, to adjust both the spacing between antennas and the relative phase of the currents flowing in them. The test fixture illustrated in Fig. 1 was constructed so that each of the 1/10 scale models might be rotated about its own axis. (As was to be expected from the perfectly circular pattern of a single 54A antenna, this rotation of one of the antennas about its own axis produced no measurable effect.) The spacing between antennas was made adjustable from a minimum of about .325 wavelength to a maximum of 1.4 wavelength, the spacings being measured between the axes of the two antennas.

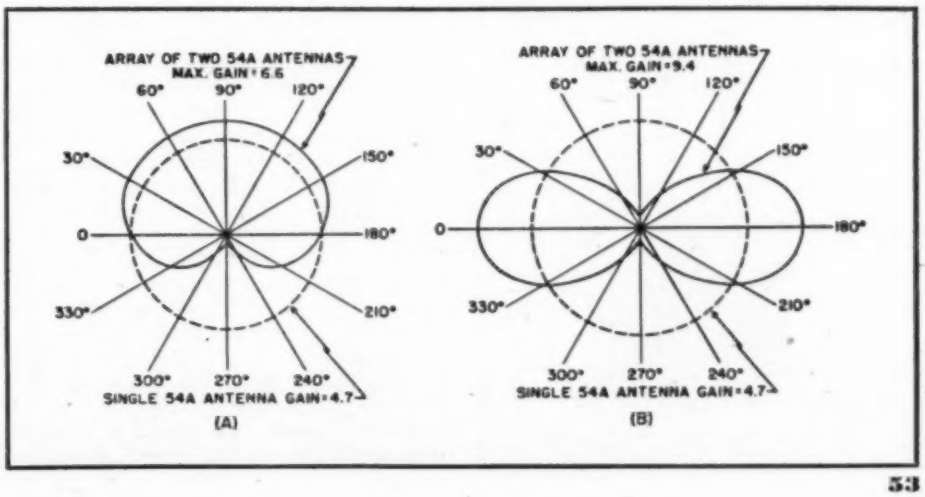
No provision was made for adjusting the ratio of current magnitudes. Relative phase of the antenna currents was controlled by means of a variable tap in the feed line bridle. This tap may be seen in Fig. 1 just in front of the base of the test fixture. By sliding the tap to the left the current in the left antenna was made to lead that in the right antenna and vice versa. The maximum phase difference obtainable by means of the tap shown was about 270 degrees. In practice, phase differences in excess of 180 degrees would not be required.

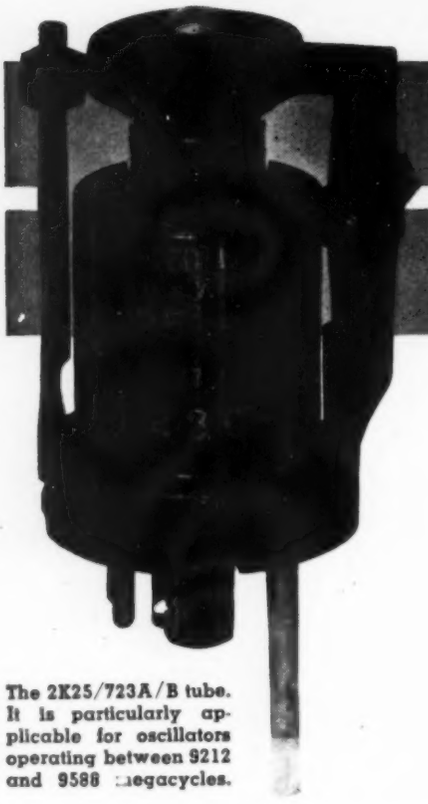
The assembly shown in Fig. 1 was mounted on a pedestal four feet high (not shown), and secured by its mounting flange to a support plate which could be rotated through 360 degrees in the horizontal plane. This plate, in turn, was mounted on a horizontal axis which provided free movement in a vertical plane. By combining these two movements properly, it was possible to achieve any combination of tilt and horizontal orientation.

In the measurement of field intensities, the flexibility of orientation of the array proved to be a great convenience. Instead of moving the receiving antenna about the array in order to observe the radiation pattern produced, it was found desirable to determine the distribution of field intensity in all directions above the earth plane by use of fixed locations for both the array being tested and

(*Continued on page* 143)

Fig. 2. Two specific radiation patterns that were obtained with this array.





The 2K25/723A/B tube. It is particularly applicable for oscillators operating between 9212 and 9588 megacycles.

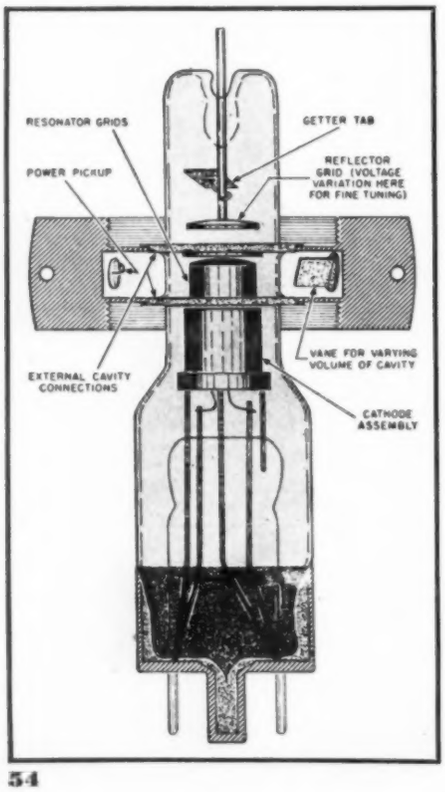
HIGH FREQUENCY LOCAL OSCILLATORS

By SEYMOUR FISHMAN

Theory and operation of several special type tubes used extensively for high-frequency oscillators.

THE function of a local oscillator in a receiver is to provide a radio carrier frequency that can be heterodyned against a desired incoming signal to produce a certain fixed intermediate frequency. The output of the local oscillator must be of a stable frequency to obtain the optimum performance from the preset i.f. amplifiers. Also, the frequency must be adjustable within a range to accommodate all the frequencies which the receiver is expected to handle. The power of the local oscillator output is also a factor to be considered in design since it is necessary to have the heterodyning carriers of the same power magnitude in order to produce an undistorted i.f.

Fig. 1. Internal view shows construction details of the McNally tube, W.E. 707A.



At very high frequencies a number of special problems are encountered, in addition to those normally found at the present commercial and amateur frequencies. For example, there is the special tube problem. Conventional tubes are inadequate because of transit time effects (the time required for electron action across the relatively widely spaced tube elements limits the maximum frequency output of the tube). Reduction of the grid spacing overcomes this difficulty but also reduces the power output of the tube because of the necessity for using lower grid potential differences. Another approach to the solution of the tube problem is found in velocity modulated tubes, such as the Klystron. In this type of tube complete circuit electron flow does not provide the energy for oscillation, but rather the bunching of electrons as they move at different speeds in the space between the cathode and the plate.

Another special difficulty is that the very small magnitude of the inductive and capacitive circuits is very difficult to produce with the necessary degree of accuracy. The smallest defect in a 3 $\mu\mu$fd. capacitor produces a large percentage of error in capacitance and consequently the frequency output of the oscillator. Also the distributed capacitance and inductance of connecting leads, filaments and tube elements which are relatively unimportant at the present working frequencies become very important above 1000 megacycles because they are comparable to the values required for the oscillatory circuit.

Consequently, the effect of distributed capacitance and inductance must be very carefully taken into account in the design of the high frequency local oscillator. In many high frequency receivers the entire oscillator circuit capacitance used is the distributed capacitance of tubes and parts.

Another important obstacle in the construction of a good high frequency local oscillator is power loss. At high frequencies the loss due to skin effect in conductors increases, as do radiation losses and dielectric losses.

The heart of the local oscillator is the vacuum tube used. At high frequencies there are two general types in use, the small triode and the velocity modulated tube. The triodes cover the lower end of the frequency band of interest here fairly well. A good example of the small triode is the *RCA* 955, commonly called the "Acorn," which can be made to produce frequencies up to 600 mc. However, the best operating conditions are to be found at only 50 mc. where there is a power output of 500 milliwatts. The power output drops off moderately up to 300 mc. but decreases rapidly above that. Another type of triode, the "Doorknob" tube, the *W.E.* 316A and 368A have a higher maximum frequency and more power. The *W.E.* 316A can produce frequencies up to 750 mc. with a 6 5 watt output at 500 mc. The *W.E.* 368A produces up to 1250 mc., but has reduced power because of the aforementioned reduced grid spacing. At 1250 mc. this tube will usually produce about 3 watts.

Another triode, which is not completely conventional, is the *G.E.* "Lighthouse" GL446. This tube is in the 3000 mc. (10 cm.) class. A cross-sectional view of this tube is shown in Fig. 2A. Essentially this is a tuned-plate tuned-grid oscillator with a grid return as indicated in Fig. 2B. The resonant circuit consists of a pair of tuned lines, one from grid to cathode and the other from plate to grid, as indicated in Fig. 2C. Tuning is accomplished by plungers *A* and *B* which effectively change the length of the

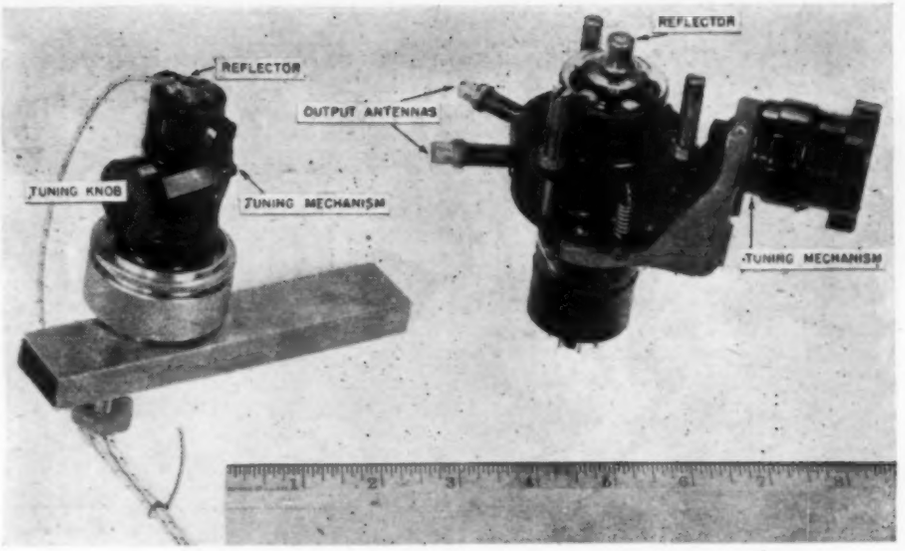
shorted section of line and consequently the frequency at which it is resonant. Power pickup is by means of the probe *C*. The output of this tube is relatively low, about 50 mw. at 300 mc. A later "Lighthouse" tube, the GL464 has increased power output to 100 mw. at this frequency.

Among velocity modulated tubes, the *Sperry* Klystron, is best known and most commonly used. The K417 Klystron is in the 3000 mc. band, with a tuning range from 2727 mc. to 3300 mc. approximately. Electrical tuning is accomplished by varying the voltage on the repeller plate. This will provide a tuning range of approximately 5 megacycles between the half power points. The mechanical adjustments of the cavity will provide the extreme limits of frequency variation described above. The power output of this tube is about 150 mw. at maximum acceleration voltage and plate current.

The *McNally* tube, the *W.E.* and *Raytheon* 707A, Fig. 1, another velocity modulated tube which operates at about the same frequency as the K417, has a wider and more easily adjustable tuning range than the K417. By means of repeller voltage variation alone, the frequency may be adjusted through a range of 30 mc. and from 2500 mc. to 3750 mc. by means of mechanical adjustment of the resonator cavity. This tube has a much lower "Q" than the Klystron because the resonator has a greater surface and there is glass running through the tube. At maximum accelerating voltage and plate current this tube has a power output of only 75 mw.

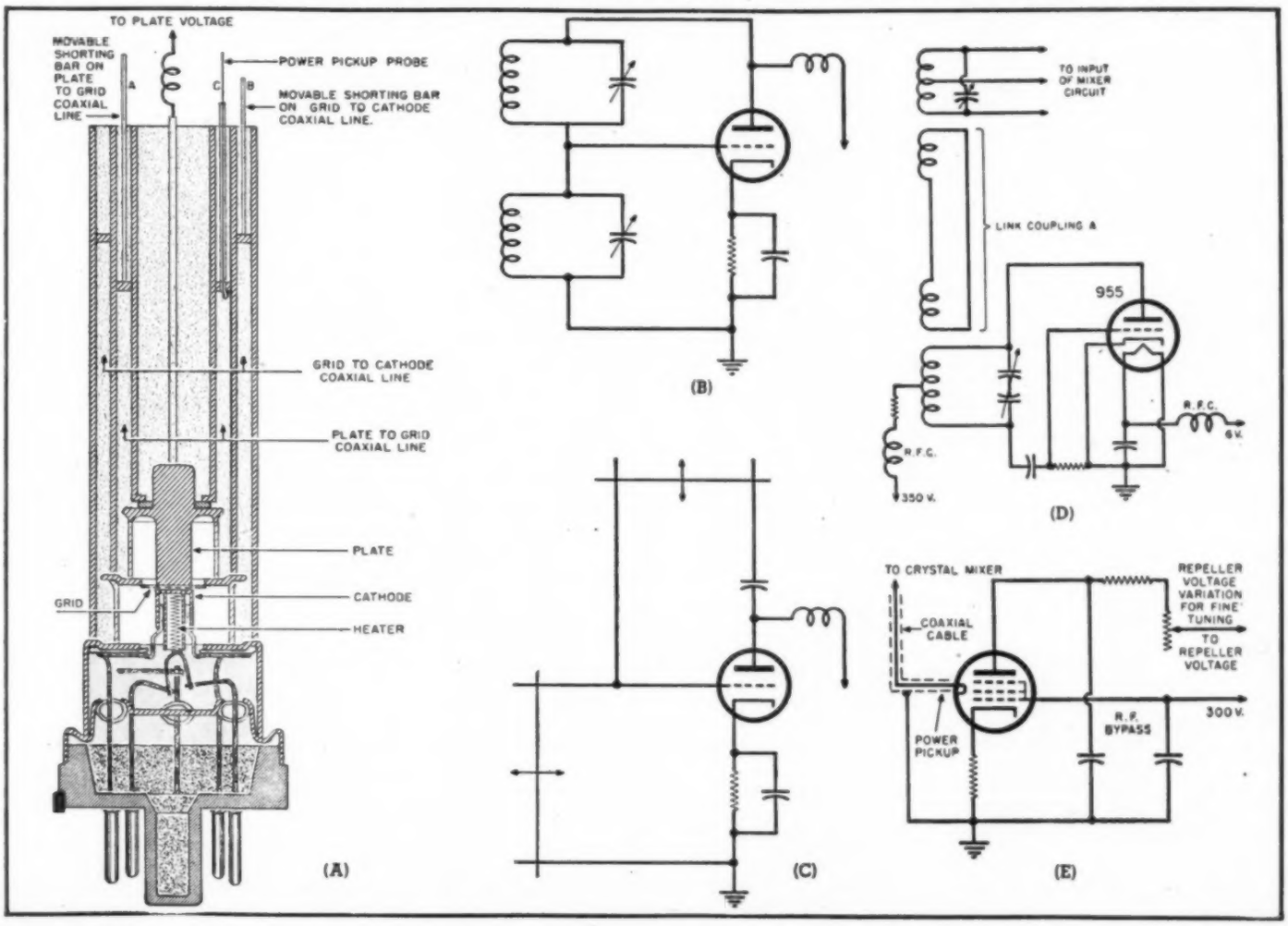
The *Shepherd Peirce* tube, the *W.E.* 723A operates at about 9400 mc. By means of a cantilever screw which changes the buncher grid spacing mechanically, the frequency can be varied roughly from 9212 mc. to 9588 mc. Fine frequency adjustment within a range of 45 mc. can be accomplished by varying the voltage on the repeller plate. Typical power output of this

(*Continued on page* 86)

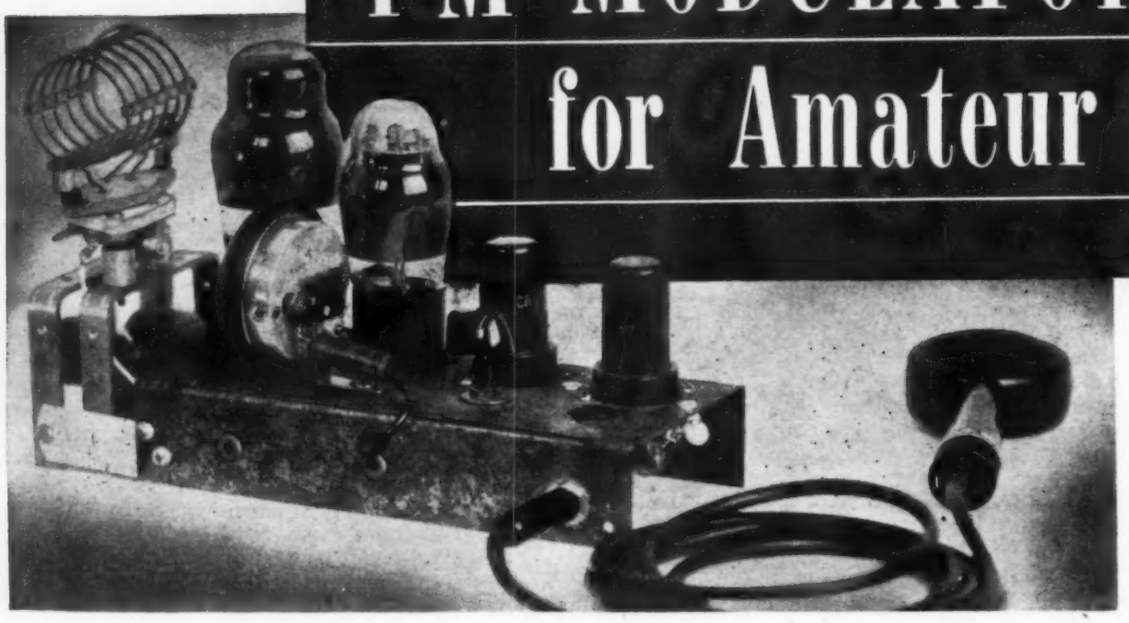


Two well-known, high-frequency tubes. (Left), wave guide mounted 723A Klystron for 3 centimeter operation and (right) 417A Klystron for operation at 10 centimeters.

Fig. 2. (A) X-ray drawing of internal construction of the GL-446 Lighthouse tube. (B) Equivalent oscillator circuit for this tube and (C) equivalent coaxial line circuit. (D) Circuit diagram of a local oscillator using the RCA 955 triode tube. (E) Local oscillator in the 3000 megacycle range using the Shepherd Peirce tube.



FM MODULATOR for Amateur Use



Photograph of home-built FM modulator. A crystal microphone is used for the input. The converted headphone used to produce an FM signal is mounted on the chassis.

By J. C. DAVIS, W4ATO

Frequency modulation is produced by a converted headphone across the oscillator grid tank circuit.

IN THE interest of discovering the simplest method for producing a frequency modulated signal, one which may be used by the ham until more elaborate equipment is available or which can be used for portable or emergency work, it was decided to make practical use of the so-called "condenser mike" method of frequency modulation.

This is the purest, simplest, and possibly one of the earliest forms of frequency modulation, wherein use is made of a condenser microphone head to frequency modulate a variable frequency oscillator when connected in shunt with the oscillator grid tank.

In case you have forgotten the principle of operation, it will be described in some detail here. Sound waves, or vibrations, striking the thin diaphragm of the condenser mike cause a symmetrical variation in the electrical capacity between the thin vibrating diaphragm and the thick stationary diaphragm of the condenser mike and produce a similar variation in the frequency of the oscillator to which it is connected.

It is obvious that this method is impractical for most purposes, including ham radio, as the connecting wires between the condenser mike and the oscillator tank would have to be as short as possible (not over a few inches in length) in order to assure frequency stability and eliminate r.f. losses, etc. For instance, the oscillator can not be held up to speak into the microphone without causing frequency shift due to body capacity and changes in position.

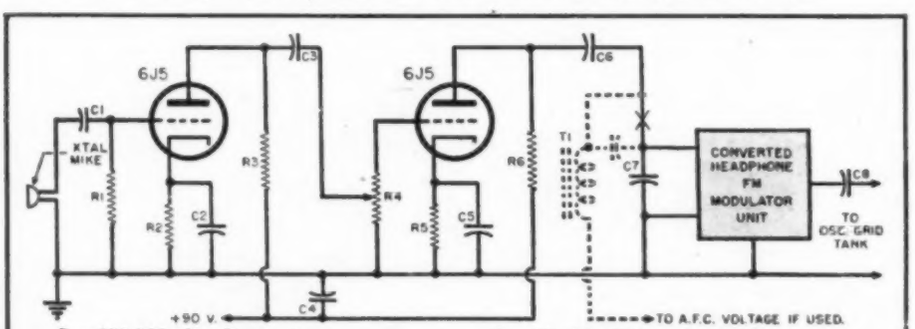
However, a method was developed by which practical use can be made of this simple system by combining the condenser mike with a unit from an old headset and substituting the headset unit diaphragm for the thin diaphragm of the condenser, then driving the headphone unit diaphragm with an audio voltage applied to the headphone unit coils, by a single button carbon mike and matching transformer, or a crystal mike and a one or two stage speech amplifier.

This method permits the condenser mike to be connected with short leads to the oscillator tank, and rigidly mounted for stability. The speech amplifier or carbon mike matching transformer can either be built, or mounted, on the same chassis with the oscillator, or set apart from it and connected to the headphone unit by the headphone cord or a twisted pair. The carbon or crystal mike can then have the usual length cord and its movement will not affect the frequency of the oscillator.

By using this method of modulation, it is possible to obtain a total deviation of as much as .01 per-cent of the fundamental frequency, depending on the applied audio voltage and the headphone construction.

Crystal oscillators can also be frequency modulated by this method if the crystal is replaced by a tuned circuit and the condenser mike connected across this tuned circuit, thus converting the crystal oscillator into a frequency modulated, tuned grid, tuned plate variable frequency oscillator.

Fig. 1. Complete circuit diagram of FM modulator using crystal mike input.



R_1—250,000 ohm, ½ w. res.
R_2, R_5—1000 ohm, ½ w. res.
R_3, R_6—100,000 ohm, ½ w. res.
R_4—250,000 ohm pot.
C_1, C_3, C_6—.01 μfd., 400 v. cond.
C_2, C_8—5 μfd., 25 v. cond.
C_4—20 μfd., 150 v. elec. cond.
C_7, C_8—100 μμfd. mica cond.
T_1—12-20 hy. audio choke
1—Crystal microphone
2—6J5 tubes
1—FM modulator unit

Break circuit at X for a.f.c. voltage, if used.

Converting the Headphone

A condenser mike was made by attaching an extra diaphragm to the cap of a unit from an old pair of headphones, placing a thin insulating paper gasket over the diaphragm and replacing the cap on the headphone unit. This gasket should be between .006" and .010" thick (as a guide, ordinary newsprint is approximately .003" thick). This ring gasket serves the dual purpose of separating and electrically insulating the added diaphragm from the headphone unit diaphragm. This results in a condenser mike with the headphone unit diaphragm serving as a condenser mike (vibrating), changing the audio signal into a capacity variation.

As shown in Fig. 4, the gasket will not be required if a headset with a built-up edge inside the cap is used. The added diaphragm was cut a bit smaller in diameter than the headphone unit diaphragm, the space serving to insulate the diaphragms from each other while the built-up edges hold them apart.

Figs. 1 and 2 show the circuits which were used for testing the converted headphone unit as an FM modulator. Both circuits worked satisfactorily and require no explanation. The type or choice of speech amplifier circuit, or the type of mike to be used may be selected from conventional circuits.

The circuit of Fig. 2 may be used for portable or emergency setups. A single button mike is required in order to produce sufficient drive without the use of a speech amplifier. The transformer is required in order to obtain proper impedance match between the low impedance carbon mike and the high impedance headphone and to prevent carrier shifts which would occur when the carbon mike is tilted.

If the carbon mike is connected direct to the headphone unit, in series with the mike battery and without a transformer, the d.c. following through the headphone unit coils would vary each time the carbon mike is moved about or tilted, causing changes in the resting position of the headphone unit diaphragm (with respect to the position of the stationary diaphragm) and resulting in a change in the resting capacity between the two diaphragms. This will result in similar changes in the resting frequency of the oscillator and therefore the transmitter carrier.

For the same reasons, capacity resistance coupling was used to the speech amplifier output (Fig. 1) thereby removing the plate current of the tube from the headphone unit coils, as this would otherwise cause a frequency drift either when the tube heats, ages, or is replaced.

When connecting the headphone unit modulator in parallel with the oscillator grid tank, as it will be connected in most oscillators with which it is used, its capacity will lower the frequency of the oscillator, thus requiring a retuning of that unit. It is preferable, therefore, that the retuning be accomplished by reducing the tank capacity, if possible, rather than reducing the number of turns on the tank coil to compensate for the shunt capacity of the unit. C_s, which is in series with this unit, serves to reduce this shunt capacity and to reduce the percentage deviation (depending on the value of capacity used). The percentage deviation, at a fixed audio level (audio drive) to the unit, will be found to increase with an increase in the frequency of the r.f. being modulated. This means that different audio levels are required for different amateur bands. An a.f.c. voltage may be applied at point *X* in either Figs. 1 or 2 by the addition of a conventional a.f.c. circuit. This will permit indirect crystal control of the oscillator frequency.

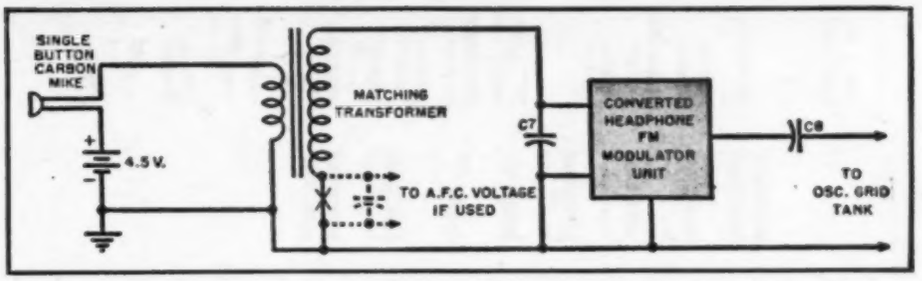


Fig. 2. Simplified circuit using headphone for the FM modulator unit which may be used for transceiver. It is particularly applicable to portable or emergency rigs.

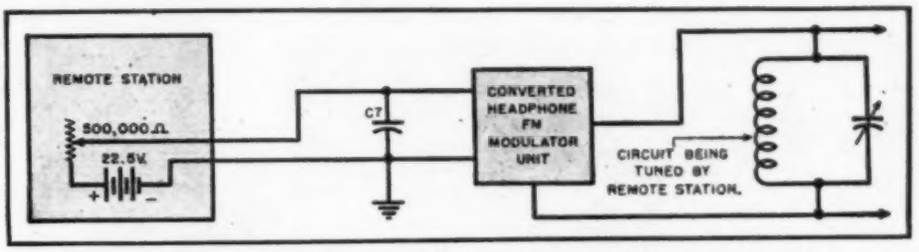


Fig. 3. FM frequency shifting circuit that can be actuated from remote position.

In converting the headphone unit, the added stationary diaphragm was cut from a metal coffee can. A flat head screw was soldered in the center of the diaphragm and was then bolted to the headphone unit cap (Fig. 4) through a countersunk hole in the center of the cap. An extra nut was added to the bolt to hold a soldering lug. A hole drilled at the exact center of the diaphragm aided in soldering the screw head to the unit. Two small holes were drilled near the center of the diaphragm to reduce damping.

To connect the headphone unit diaphragm, a unit with an aluminum case was used, and the case mounted to the chassis with a metal bracket which served to ground the headphone diaphragm. The edge of the diaphragm was scraped to provide a good electrical contact with the aluminum case. If a bakelite case is used in preference to the aluminum one, it will be necessary to bring out a connection from the diaphragm for ground.

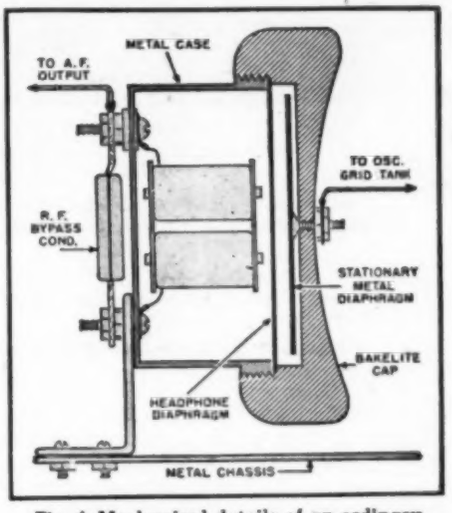
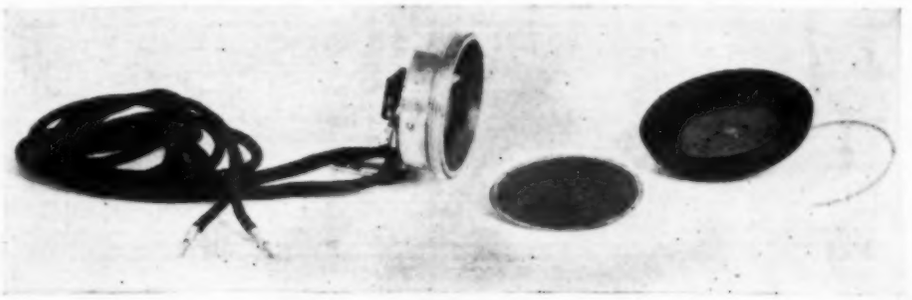


Fig. 4. Mechanical details of an ordinary headphone unit that has been converted for frequency modulation operation.

Substituting a thinner diaphragm in the headphone for the one used will help to reduce damping if such a procedure is found necessary to improve reproduction. It should also be noted that while the added diaphragm may

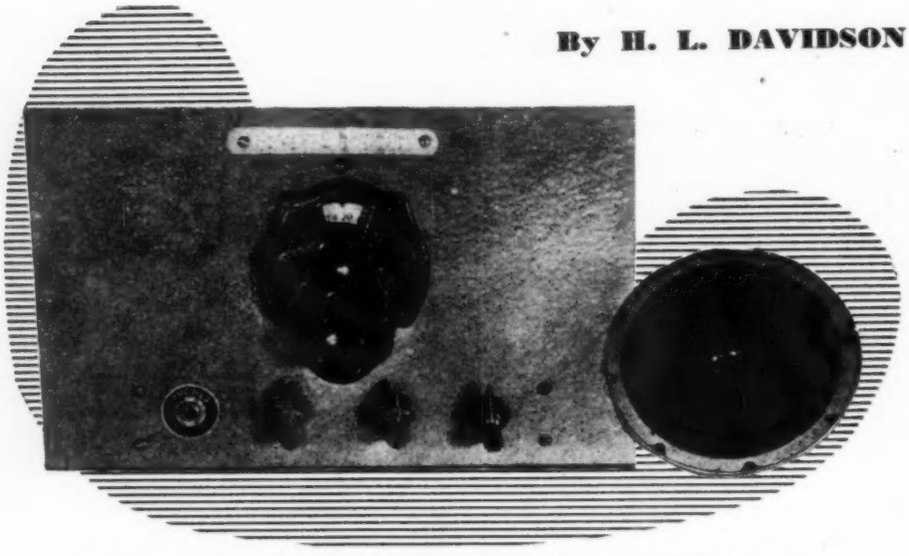
(*Continued on page* 120)

Photograph of converted single headphone as it was rebuilt by the author.



3-Tube Short-Wave RECEIVER

By H. L. DAVIDSON



Panel view of home-built 3-tube receiver. Controls from left to right are: phone jack, regeneration control, R_2, tuning condenser, C_2, and volume control, R_4.

This easy-to-build receiver, using plug-in type coils, covers broadcast and short-wave bands.

SINCE the war ended, interest in short-wave reception has reached a new high. What was needed here was a small short-wave receiver that would provide both phone and speaker reception. With the scarcity of power transformers, an a.c.-d.c. receiver was the answer.

This small receiver was built to cover the broadcast and short-wave bands from 20 to 160 meters. This includes the ham bands, short-wave stations, and many other services. To cover these different bands, plug-in coils are used. The receiver circuit is shown in Fig. 1 and incorporates the following tubes; 12SJ7 as a regenerative detector; 12J5, 1st audio stage, and 50L6GT output. A 35Z5GT is used as a half-wave rectifier.

Several methods of regeneration control were tried, but the one shown and used here was the most successful. Regeneration is controlled in the screen grid circuit by varying the voltage on the screen grid of the 12SJ7. A conventional tickler feedback circuit is used and the grid coil tuned with a 140 $\mu\mu$fd. variable condenser paralleled by a bandspread condenser of 35 $\mu\mu$fd. capacity. Complete coil winding data is given in the accompanying table. A common ground wire is brought to each individual socket and grounded directly to the chassis at both ends. This method eliminates high resistance joints which often exist when soldering to the chassis.

Be sure and ground socket terminal #1 of the 12SJ7 detector. This tube should be a metal type, although a glass type will do if a tube shield is placed around it and grounded.

The rectified or audio signal is coupled through a grid condenser to the grid of the first audio stage. A triode is used for this stage. The tube is used with cathode bias. An unbypassed 2500 ohm, ½ watt resistor provides the bias. The volume is controlled in the grid circuit of the 12J5 since the phones are placed in the plate circuit of the 12J5. The volume control has a switch on the back to turn the receiver on and off.

Mechanical specifications for constructing the necessary plug-in type coils.

	GRID COIL (L_2)	TICKLER COIL (L_1)	WIRE SIZE
Broadcast band	120 t.	35 t.	28 e.
160 meters	60 t.	18 t.	28 e.
80 meters	35 t.	12 t.	28 e.
40 meters	18 t.	10 t.	28 e.
20 meters	10 t.	8 t.	28 e.

All coils are to be wound on 1¼" diameter plug-in type coil forms.

Tickler winding to be spaced ⅛" from ground end of grid coil.

40 and 20 meter coils are to have a winding length of 1", while other coils are to be close-wound.

Note: Tickler coil turns might need to be increased or decreased slightly to give correct feedback.

The plate circuit is not broken when the phones are plugged in. A 100,000 ohm resistor furnishes plate voltage at all times. A shorting type jack is used so that, as phones are plugged in, the contact to the grid of the output stage is broken. When the phones are inserted, the circuit is completed through the .05 μfd. condenser, phones and ground. The loudspeaker is now inoperative and quiet, and personal listening is provided.

The output stage uses a 50L6GT tube. This power amplifier uses cathode bias with a bypass condenser. The bypass could be eliminated, but greater speaker volume was obtained by leaving it in the circuit. A .005 μfd. plate condenser must be placed in the plate circuit of this tube or the 50L6GT may oscillate with the incoming signal.

The output of the final amplifier stage feeds directly into an octal tube socket mounted at the rear of the chassis. An octal tube base plugs into this socket. A 3-wire cable connects to the dynamic speaker.

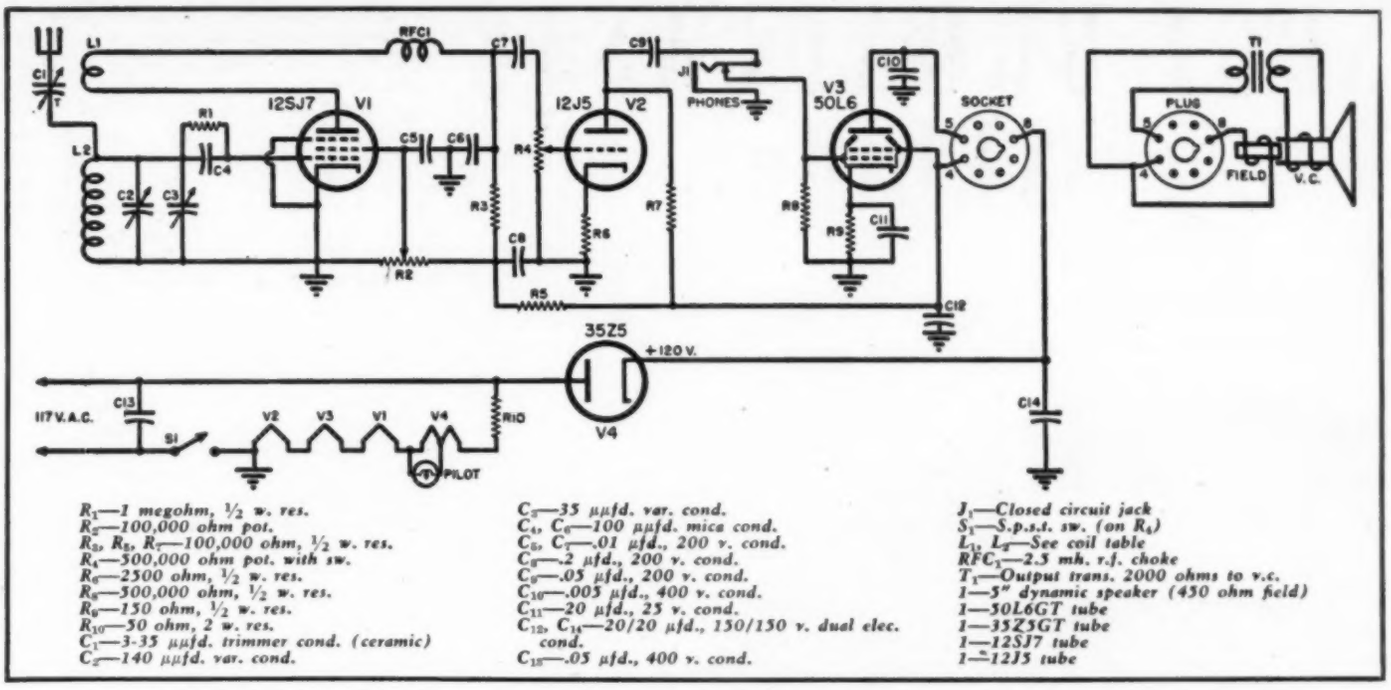
All screen and plate voltages are furnished by the 35Z5GT rectifier. With a combination 20/20 μfd. dual electrolytic condenser and dynamic speaker field for filter, only a small audible hum can be heard in the speaker. Originally a condenser-resistor filter circuit was used in conjunction with a PM speaker, however, larger filter capacitors were needed and the plate voltages were quite low. With the type of arrangement used here, less hum was developed with an increase in output voltage.

To add to the appearance of this short-wave receiver, a small 150 ma. pilot light was placed on terminals #2 and #3 of the small rectifier tube. This pilot light is a No. 40. Any .15 amp. 5 to 8 volt pilot bulb may be used. The voltage at the output of the filter is 90 volts under load conditions.

Since all of the tubes used are the 150 milliampere variety, requiring a total of 110 volts, a small resistor must be placed in series with the heaters to reduce the heater voltage slightly, as the standard line voltage is 117 volts. A 50 ohm, 10 watt resistor placed in series with these tubes reduces the line voltage to the proper value. A .05 μfd. paper condenser is placed across the line to eliminate any incoming line noise.

Chassis Construction

The chassis is constructed from No. 16 gauge sheet metal and measures 8½" long by 6" wide. A ½" reinforcement strip is bent at both ends to provide more rigidity. Socket tube holes were drilled with a small drill and then enlarged with a rat tail file. This operation will be much simpler if the constructor owns a circle cutter or a socket punch. These holes are $1\frac{5}{32}$" in diameter so that the type of socket which mounts with a retaining ring can be used. If regular wafer sockets are used, it will be necessary to drill two extra ⅛" holes per socket, for the mounting screws.



R_1—1 megohm, ½ w. res.
R_2—100,000 ohm pot.
R_3, R_5, R_7—100,000 ohm, ½ w. res.
R_4—500,000 ohm pot. with sw.
R_6—2500 ohm, ½ w. res.
R_8—500,000 ohm, ½ w. res.
R_9—150 ohm, ½ w. res.
R_{10}—50 ohm, 2 w. res.
C_1—3-35 μμfd. trimmer cond. (ceramic)
C_2—140 μμfd. var. cond.
C_3—35 μμfd. var. cond.
C_4, C_6—100 μμfd. mica cond.
C_5, C_7—.01 μfd., 200 v. cond.
C_8—.2 μfd., 200 v. cond.
C_9—.05 μfd., 200 v. cond.
C_{10}—.005 μfd., 400 v. cond.
C_{11}—20 μfd., 25 v. cond.
C_{12}, C_{14}—20/20 μfd., 150/150 v. dual elec. cond.
C_{13}—.05 μfd., 400 v. cond.
J_1—Closed circuit jack
S_1—S.p.s.t. sw. (on R_4)
L_1, L_2—See coil table
RFC_1—2.5 mh. r.f. choke
T_1—Output trans. 2000 ohms to v.c.
1—5" dynamic speaker (450 ohm field)
1—50L6GT tube
1—35Z5GT tube
1—12SJ7 tube
1—12J5 tube

Fig. 1. Schematic diagram of 3-tube receiver. When phone plug is inserted in jack, J_1, speaker is automatically silenced.

An additional socket hole was drilled for an octal socket to accommodate the speaker cord. The mechanical layout for the panel and chassis are shown in Fig. 2.

The front panel has four ⅜" holes located close to the bottom of the panel. This panel is constructed from the same material as the chassis. It is best to drill all holes before doing any painting, as it is very easy to mar the finished surface. The front panel has a finished appearance when painted with crackle finish paint. The color used here was a light green, although any color will do.

It is always best to mount all of the large parts first, such as tube sockets, the filter condenser, volume controls and variable condensers. Then, while wiring the set, the small condensers and resistors can be soldered into place. For mounting and wiring convenience, the front panel is not put into place until all the wiring is about complete. The variable condenser, volume control, regeneration control, and phone plug are put in place as if the front panel were on. Later they can be loosened and the front panel can be placed in position.

There are many ways to wire a receiver but the preferred method is to first wire the complete a.c. and filament circuit, then start with the antenna and wire clear through, back to the power supply. Before too much wiring is done, the ground or common terminal wire should be placed and soldered to each tube socket and also to the chassis.

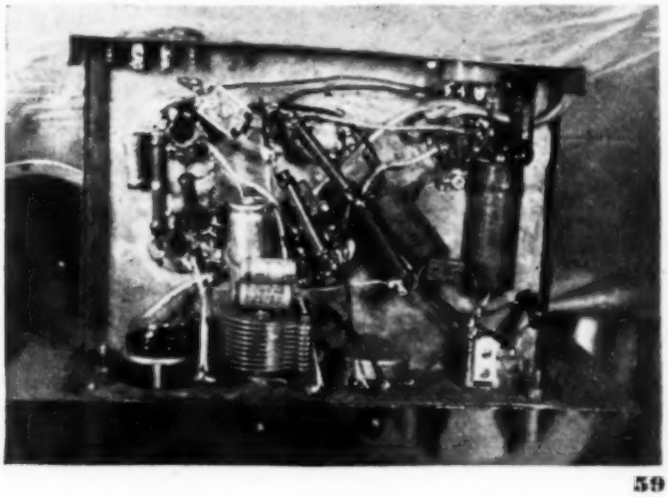
When the wiring has been completed, the circuit should be checked, for nothing is so discouraging as to have a receiver not function properly when it is completed. After completion, the broadcast coil may be plugged into its socket as well as all vacuum tubes. With the power plug in the socket, turn on the a.c. switch. The pilot light should become bright and then slowly die down. The tubes should have a dull red glow.

If a small audible hum is heard from the speaker, the d.c. power supply may be assumed to be working correctly. Turn the regeneration control slowly in a clockwise direction, with the volume control turned full on. A loud whistling noise should be heard. If nothing happens, turn the receiver off and reverse the two tickler leads. Try this method again and the squeal should be quite audible. Slowly back the regeneration control off, until the squeal is just barely audible and vary the tuning condenser. Leave the bandspread condenser set at any place on the dial. As the condenser is rotated, broadcast stations should be heard, accompanied by a slight squeal. Reduce the regeneration control until the station is heard clearly.

(*Continued on page* 175)

Side-rear view of receiver. The speaker is remotely placed, connected to the receiver through a three-wire cable. If desired this speaker may be mounted directly on the chassis.

Bottom view of completed receiver. Note that coarse tuning condenser, C_2, is placed under the chassis, while vernier tuning condenser, C_1, is mounted in center of front panel.



SPOT BROADCASTS SELL!

Servicemen-dealers should not overlook the sales possibilities of local station spot announcements.

A vast audience of housewives can be reached by a message at small cost.

By W. C. ROUX
Mgr., Spot Advertising Dept., NBC

TODAY, for anyone to ask "shall I use radio?" is much the same as asking "shall I advertise?" Size has nothing to do with it, nor dollars—but sense has, if you pardon the wordplay.

Here is an advertising medium which is the brightest star in the sales firmament, a star that first glowed dimly about twenty-five years ago but whose candlepower has increased so phenomenally that its place in the world is most significant. But you know as well as we the place radio has assumed in the home and community life. You are primarily interested in how you can use it as an advertising medium. We can say, without qualification, that broadcast advertising, network and non-network, national and local, is too vital to be ignored, too successful to be overlooked by any businessman who is seeking more business.

Too often we hear "we can't compete with the big network shows. Radio costs too much money." So do four-color pages. And so do full pages in newspapers under certain conditions—for the local merchant. Yet he never draws this comparison when he is thinking about newspaper advertising. Perhaps full pages are too much for his budget. But there are half pages, quarter pages, single inches. And every unit of space will produce in proportion. This is the language the local merchant understands. His thinking about radio, however, does not follow the same lines. And it should! Because radio has the same relative values to offer.

Every local radio station in the country has everything from a full hour to a station break to offer advertisers. An advertiser can buy a half hour, a quarter hour, ten minutes, five minutes or one minute. He can buy a share in a home forum program or a farm hour. And he can buy any of these units (or a combination of them) once a day, once a week or several times a day, seven days a week. In other words, he can cut radio's cloth to fit his pattern. And it will more nearly fit than any other advertising cloth.

The flexibility of radio, in programming and in scheduling, is its greatest asset for local advertisers. A radio advertiser selects the type of program he wants, at the time of day he wants—all in line with his budget. Thus he can reach the whole family before and at breakfast, the women during the day, the children in the late afternoon and the men and women at night. He can gear his sales talks as well as his programs to the audience he wants to reach.

That radio advertising gets results is well known. That there have been failures is equally well known. But there have been practically no failures by advertisers whose products or services are fair purchases and whose radio advertising has been well thought out, carefully planned and consistently used. To use radio half heartedly is like turning your back on an interested customer in the store.

If you do not have an advertising agency, get in touch with your local radio stations' sales departments. Ask them about available programs and times. But first, tell them your problems. Tell them what you want to accomplish, what products you want to emphasize, what services you have to offer that set you apart from your competition. Give them an indication of how much you want to spend—not this week or next, but for six months or a year. Inform them fully of seasonal fluctuations in your business. In short, tell them all so that they may in turn help you think, help you plan, help you build a campaign, help you to merchandise it. The last point is important—merchandising, tying in your radio advertising with your store displays, your window displays and your direct mail and other advertising. Remember, radio is unique among advertising media; it is invited into the home by various members of the household all day long. And reminders of your programs bring larger audiences!

What is said in your sales messages and how it is said is, obviously, the basis of their success. Even though you may have a hundred different items in your store it is best to feature only one in an announcement—one product or one department. Use it as your leader if you want, but paint the word picture of its qualities as well as you can with the help of the station's commercial writers. Just as you are expert as a merchant so are they experts in writing radio sales messages.

Generally speaking, the radio sta-

(*Continued on page* 90)

Build this Radioman's R-C BRIDGE

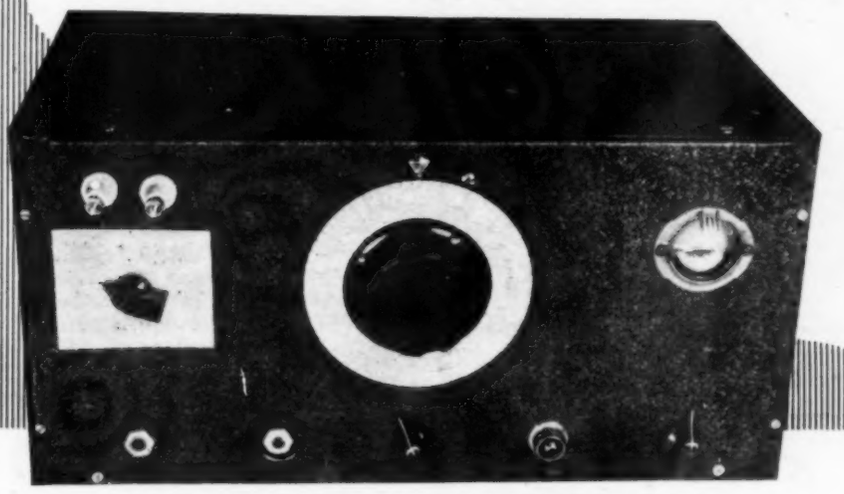


Fig. 1. Front panel view of home-built test instrument. For correct identification of various controls refer to Fig. 3.

By RUFUS P. TURNER, W1AY
Consulting Eng., RADIO NEWS

Complete construction details for a resistance capacitance bridge. This wide range instrument will find many applications in the service shop.

HERE is a compact, wide-range resistance-capacitance bridge of marked usefulness, that can be built by any serviceman. Although it is sensitive, stable, and rugged, this instrument is inexpensive. Its attractive ranges will catch the eye of the amateur experimenter as well as the repairman. This small bridge is completely self-contained, as Fig. 1 shows, and it is fully a.c. operated. There are no tricks either in its operation or calibration, this instrument being entirely conventional and foolproof and direct reading. We believe many radiomen will want to build it.

Ranges

There are three capacitance ranges: 1 $\mu\mu$fd. to 0.1 μfd., 0.0001 μfd., to 10 μfd., and 0.01 μfd. to 1000 μfd. There likewise are three resistance ranges: 1/10 ohm to 10,000 ohms, 100 ohms to 10 megohms, and 10,000 ohms to 1000 megohms.

The main dial has a single set of graduations from which both capacitance and resistance are read. The range switch, in its various capacitance positions multiplies the main dial readings by 10, 1000, and 100,000 and in resistance positions multiplies the readings by 1, 1000, or 100,000. This arrangement provides the maximum simplicity and directness in operation of the bridge.

The exceptionally wide range of this bridge enables the operator to measure a variety of capacitances ranging all the way from small circuit values (down to 1 $\mu\mu$fd.) to the large capacitances of motor starter capacitors. Also, resistance measurements may be made from values considerably lower than 1 ohm to the high leakage resistances (up to 1000 megohms) encountered, say, in tubular capacitors.

Features

The compact RC bridge has several special features worth mentioning. These contribute to its versatility and reliability.

Sensitivity. Very high sensitivity is provided by use of (1) a high-gain 6SJ7 bridge amplifier and (2) a high signal voltage. The signal voltage is approximately 50 volts at 60 cycles, supplied by the secondary of the signal transformer, T_1 (See Fig. 2).

The sensitivity is under full control, being variable from zero to maximum by means of the amplifier gain control, R_4. Sensitivity may be made so high that an almost imperceptible adjustment of the main dial will show up in the null detector.

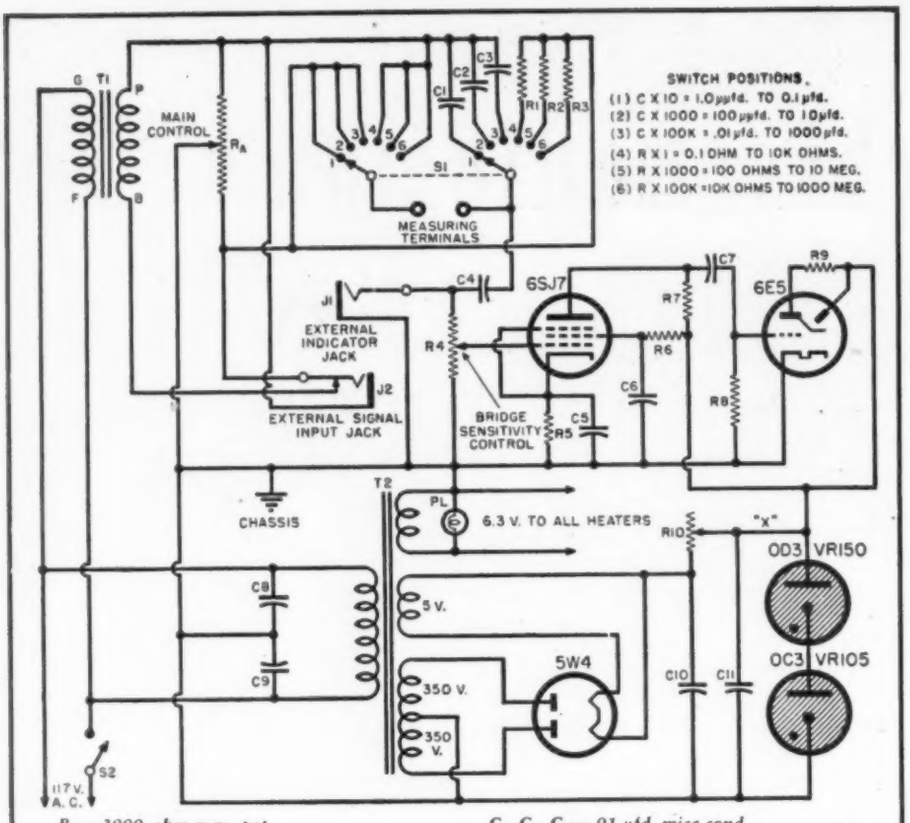
Provision for External Signal Input. Transformer T_1 delivers a 60-cycle signal voltage to the bridge circuit. This will be satisfactory for all ordinary purposes. However, some operators may prefer to use a signal of some other frequency, such as 400 or 1000 cycles, for occasional experimental measurements. For this purpose, an external signal jack, J_3, is provided in the circuit. When a plug, connected to an external audio oscillator, is inserted into J_3, the jack contacts open and automatically disconnect the secondary of the 60-cycle transformer, T_1, from the bridge circuit.

Provision for External Null Indicator. The self-contained bridge null detector is a 6E5 magic eye tube which, driven by the 6SJ7 amplifier, makes a sensitive indicator. However, some operators may prefer to use an external null indicator (such as an oscilloscope, a.c. vacuum tube voltmeter, or headphones) in occasional experimental bridge measurements. Jack J_1 permits the quick connection of such an external indicator. Neither the 6SJ7 amplifier nor the 6E5 indicator need be placed out of operation when an external indicator is plugged in.

Power Supply. A regulated a.c. power supply is employed. Our experience with various small bridges convinces us that this feature is most desirable. A line-operated (a.c.-d.c.) type of power supply would cause one of the measuring terminals to be "hot," especially on the resistance ranges, thereby creating a shock hazard. Amplifier and null detector operation tends to be unstable with an unregulated power supply.

Voltage regulation is obtained by means of the two gaseous regulator tubes connected in series, as shown in Fig. 2. The 0C3/VR105 and 0D3/VR150 together give a regulated d.c. voltage of 255 for the amplifier and indicator tubes. The regulator limiting resistor, R_{10}, with filter capacitors C_{10} and C_{11}, provides sufficient filtration without having to use a filter choke.

The power supply components are



R_A—3000 ohm w.w. pot.
R_1—10 ohm, 1 w. res.
R_2—10,000 ohm, 1 w. res.
R_3—1 megohm, 1 w. res.
R_4—1 megohm vol. control
R_5—2000 ohm, 1 w. res.
R_6—2 megohm, 1 w. res.
R_7—300,000 ohm, 1 w. res.
R_8, R_9—1 megohm, ½ w. res.
R_{10}—5000 ohm, 10 w. w.w. res. (with slider)
C_1—.0001 μfd. silvered mica cond.
C_2—.01 μfd. silvered mica cond.
C_3—1 μfd. oil filled bathtub cond.
C_4, C_6, C_7—.01 μfd. mica cond.
C_5—10 μfd., 25 d.c. w.v. elec. cond.
C_8, C_9—.1 μfd., 600 v. cond.
C_{10}, C_{11}—10 μfd., 450 d.c.w.v. elec. cond.
J_1—Midget open circuit jack
J_2—Midget 2-circuit normally closed jack
S_1—2-pole, 6-pos. non-shorting rotary selector sw.
S_2—S.p.s.t. toggle or blade sw.
T_1—Interstage audio trans. 2:1 ratio
T_2—Midget power trans. 350-0-350 v. @ 50 ma.; 5 v. @ 2 amps.; 6.3 v. @ 2 amps.

Fig. 2. Schematic diagram of RC bridge. Test instrument covers capacitance ranges from 1 μμfd. to 1000 μfd. and resistance ranges from .1 ohm to 1000 megohms.

small in size and accordingly do not require a great deal of chassis space.

Ease of Calibration. The builder has to calibrate only one *resistance* range on the main dial. If the range switching resistors and capacitors are selected with care as to their values, the other ranges then automatically "fall in line."

The bridge calibration can be made easily with a number of hand-picked resistors, as will be explained in detail later in this article. This is a decided advantage, since most radiomen find it easier to obtain accurately measured resistors than a set of precision capacitors.

Power Factor and Q Indication. Capacitor manufacturers have not given servicemen much definite, practical information in the way of limiting power factor and Q values. For this reason, repairmen are inclined to interpret power factor *percentages* in a variety of ways. The circuit of the bridge shown here has not been complicated, therefore, by the addition of a separate power factor control. But that does not mean that a capacitor with a bad power factor or Q cannot be spotted.

Normally, the 6E5 shadow pattern opens quickly and cleanly at null. However, when a capacitor under test has high power factor or low Q, the opening of the eye is not clean—the width of "fuzz" on each side of the shadow being proportional to the power factor. A very bad capacitor will produce a narrow eye opening with a great deal of fuzz on each side. There is no blurring at all, but a sharp line between the dark and bright portions of the eye pattern, when a good capacitor is connected to the bridge.

Indication of Shorts, Opens, and Intermittents. On any of the resistance or capacitance ranges of the bridge, the 6E5 indicator will open wide at the extreme left-hand (zero) end of the dial for *shorts*, and at the extreme right-hand (full-scale) end of the dial for *opens*. Intermittents are indicated by a flickering of the eye, when the dial is set for null, especially if the capacitor or resistor is rapped sharply.

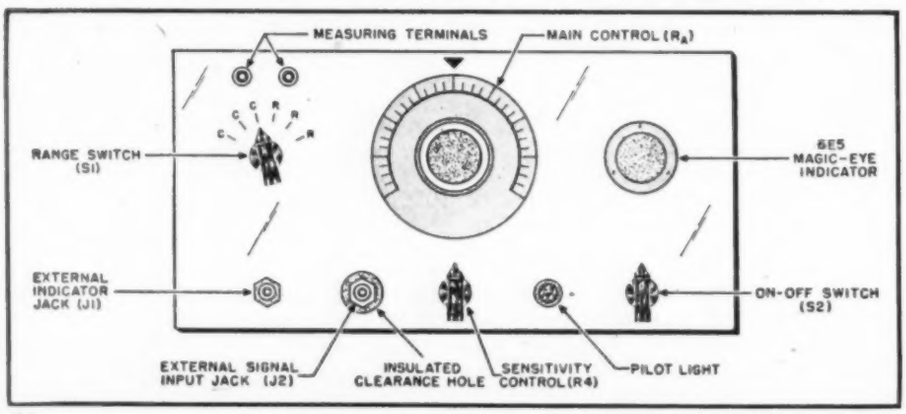


Fig. 3. Front panel layout showing placement of the various operating controls.

Circuit

The complete bridge schematic appears in Fig. 2, and an examination of this drawing will show the measuring circuit itself to be of simple, conventional design. Capacitors C_1, C_2, and C_3 are employed as standards for capacitance measurement. Resistors R_1, R_2, and R_3 are standards for the three resistance ranges. The bridge balance potentiometer, R_A, is a 3000-ohm wirewound volume control-type component. The rather high signal voltage does not cause bad heating in this potentiometer.

The 2-pole, 6-position range switch, S_1, automatically shifts the standards and measuring terminals from one bridge arm to the other when switching from resistance to capacitance functions. This enables the main dial to read in the same direction for both resistance and capacitance.

The 10 ohm, 10,000 ohm, and 1 megohm standard resistors, R_1, R_2, and R_3, must be hand picked for exact values. An accurately calibrated ohmmeter may be used for this purpose, if no other instrument is available. The author found that not many resistors had to be checked at the store in order to obtain three satisfactory standards. If the reader desires, precision instrument resistors may be employed as standards and the need for hand picking thereby eliminated.

The 0.0001, 0.01, and 1 μfd. standard capacitors, C_1, C_2, and C_3 likewise must be selected for exact values. It is best to order directly from the supplier or manufacturer capacitors having a tolerance of 1% or better. If an exact 1 μfd. value cannot be obtained for C_3, it is advisable to accept a somewhat lower capacitance and to connect enough mica capacitors in parallel with it to build its capacitance up to the required 1 μfd.

The accuracy of the bridge depends a great deal upon the accuracy of these resistance and capacitance standards, and the individual builder will do well to select them with the greatest possible care.

The signal transformer, T_1, is a 2-to-1 ratio interstage audio transformer with its secondary connected to the 115-volt line. The proper primary and secondary connections are indicated by standard lettering in Fig. 2. This transformer provides a bridge signal of a little more than 50 volts; and on long test runs, no large amount of heating was detected either in the signal transformer or in the bridge potentiometer. Any other type of transformer may be used, provided it will deliver 50 to 60 volts to the bridge circuit.

The remainder of the circuit is entirely straightforward, consisting of a conventional voltage-regulated power supply, previously described, and a standard 6SJ7 amplifier and 6E5 indicator.

With the arrangement shown, the eye opens up to indicate null points.

Mechanical and Electrical Construction

The bridge is built on a metal chassis, 12" long, 6" wide, and 2" high, and a metal front panel, 14" long and 7" high. It is enclosed in a metal cabinet. The external and internal appearance of the instrument and the arrangement of its parts may be seen in Figs. 1, 3, 4, and 5.

The main dial has a 3¾" diameter metal plate to which has been cemented a disc of thin white cardboard on which the special scale is hand drawn. After completing the calibration and drawing in the graduations with black India ink, this dial plate is covered with a matching disc of transparent celluloid or other plastic to prevent soiling.

The range switch plate (see Fig. 1) is also made of thin white cardboard which, after lettering, has been cemented to the front panel and covered with transparent celluloid. Mark this plate *Rx1, Rx1000, Rx100,000, Cx10, Cx1000,* and *Cx100,000,* corresponding to the switch positions shown in Fig. 2 and listed in detail in the range data in that drawing.

All of the standards, except the 1 μfd. capacitor, C_5, are connected directly between contacts of the range switch, S_1, and are supported by this switch. C_5 is mounted on the chassis, where it may be seen directly behind the range switch in Fig. 4. Note the two parallel-connected mica capacitors on top of, and shunting C_5.

The two voltage regulator tubes may be seen in the rear of the chassis in Fig. 4. The 5W4 rectifier tube is directly behind the left hand regulator tube.

The 3000 ohm bridge potentiometer is mounted in the center of the front panel and is supported back from the panel on a *Mallory* RB 249 metal bracket.

The 6E5 magic-eye indicator tube is

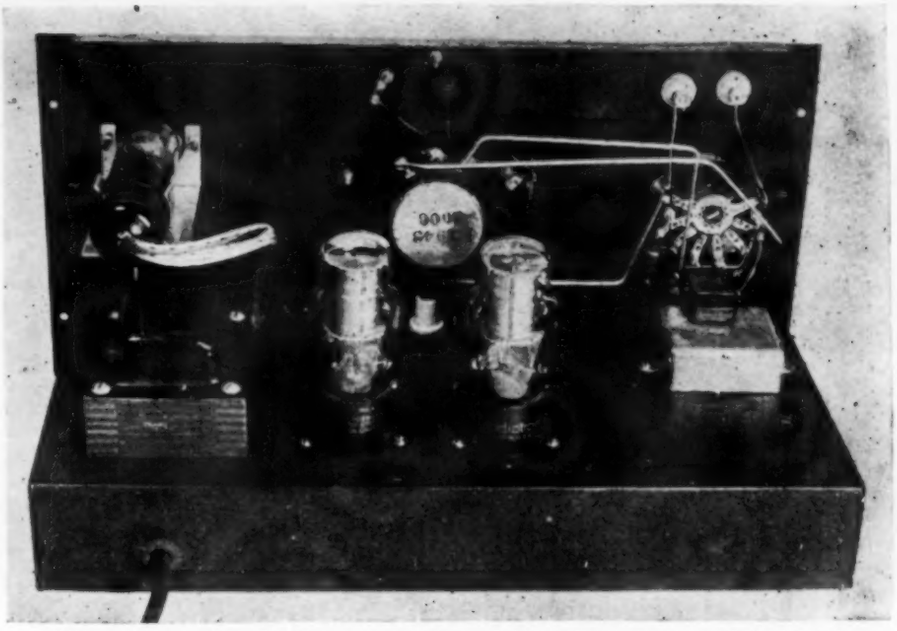


Fig. 4. Rear view of resistance-capacitance bridge. While the two OD3/VR150 tubes are visible, the 6SK7 and 5W4 tubes cannot be seen in this photograph. They are mounted directly behind the two voltage regulator tubes.

mounted from the back of the front panel, where it may be seen directly above the power transformer in Fig. 4. An *Amphenol* 58-MEA6 magic eye assembly holds this tube in position. The 5 leads from the socket of this assembly pass through a grommet-lined hole in the chassis for connections to points underneath. The 1 megohm resistor, R_9, is enclosed in the tube socket shell of the magic eye assembly. The magic eye escutcheon, also supplied with the assembly, may be seen on the front panel in Figs. 1 and 3.

The voltage regulator limiting resistor, R_{10}, is mounted between the two voltage regulator tube sockets, under the chassis (see Fig. 5). The *"On-Off"* switch, S_2; sensitivity control R_4, pilot light bracket, and jacks J_1 and J_2 also are mounted under the chassis and may be seen directly back of the front panel in Fig. 5.

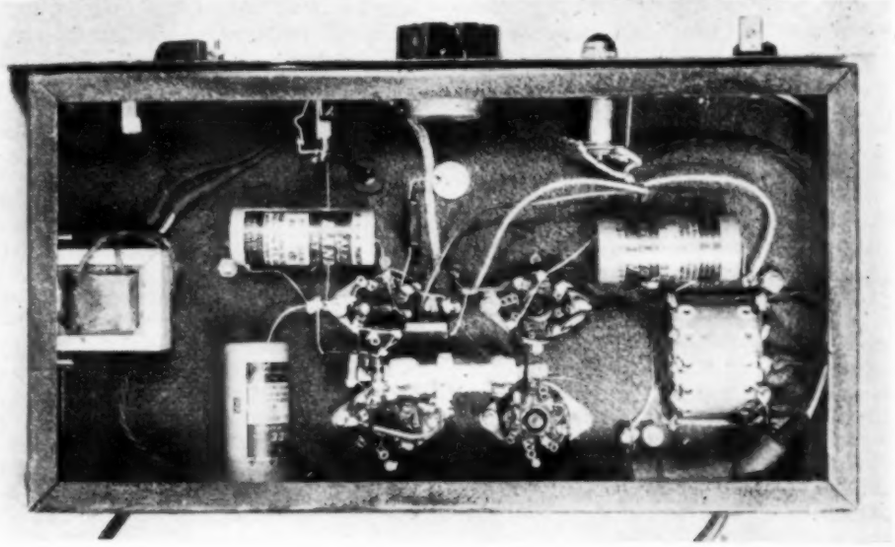
By employing two *Johnson* type 44 ceramic feed-through units as the *"measuring terminals"* (see Figs. 1 and 4), these terminals are kept out of contact with the metal front panel. Another one of these feed-through terminals passes through the chassis to connect the bridge circuit with coupling capacitor C_4 which is under the chassis near the 6SJ7 socket. This particular feed-through terminal is seen directly under the bridge potentiometer in Fig. 4.

Connections between the measuring terminals and the range switch, and between the range switch and potentiometer R_A are made with bare bus wire. These rigid connectors must be run as directly and over as short a path as possible, in order to minimize circuit capacitances.

It is advisable to shield the lead running between sensitivity control R_4 and the 6SJ7 control grid and to con-

(*Continued on page* 146)

Fig. 5. Photograph shows placement of various under-chassis components.



Make a careful survey of the available stores in the neighborhood where you are planning to locate. Don't, however, be tempted to sign a lease for the first place you see—take time, be choosey.

LOCATING Your New Store

By **WILLIAM L. MORRIS**
Vice-Pres., Adams & Co., Real Estate, Inc., N.Y.C.

The selection of a place in which to do business is the most important decision the dealer must make.

TO ANY thoughtful man in the retail business the matter of the location of his enterprise is of prime importance. He knows or at least senses that nothing can make or break his venture as can his choice of location. It is as vital a matter to the small retailer who is investing his savings, as it is to the chain store organization and to the big individual investor in a retail business.

Chains and big retailers engage the services of store locating organizations, whose experts gather data and advise. The small retailer may not be able to avail himself of such a service, however, there is nothing to prevent him from observing the principles that guide the procedure of store location for big corporations. He can adopt the same principles, look for the same controlling factors, guard against misjudgment in the same way as the large concern. How all of these elements are to be applied is outlined in this discussion.

The consideration here is directed principally to the radio and appliance dealer whose available financial means limit him to a comparatively low rental in his operational budget. This discussion is concerned primarily with the radio and appliance dealer whose budgeted rental is between $1200 and $2400 a year.

The task of locating a store for his purpose, in the case of the radio and appliance dealer of small means, is generally in his own hands, as the store location services of a large real estate organization are not, as a rule, available to him. Such store location services, which do so much of the work of spotting and evaluating loca-

Try to visualize your store in the neighborhood shopping district.

Check your prospective market by "visiting" your customers' homes. You can usually judge what type of merchandise your clientele will want from homes in which they are living.

tions for chain stores and the larger independent retail establishments, are compensated for the experience and expert facilities that they render by the brokerages on leases and they make no charge to the lessee for whom the research is done. Since the expense of this work is considerable, it is obvious that it can not usually be met by brokerages on low-rental leases. For the dealer, however, whose projected rental is moderately high the store location unit of a large and long-established real estate organization provides him with expert service at no cost to himself.

After visualizing your store, face the problem of whether a store is needed.

The first consideration of the small radio and appliance dealer must be, as it is with chains and large retailers and with the store location organizations that render them service, to look to a retail section with established buying power. This is fundamental. The section must be one to which people habitually come to buy. Pioneering in an untested section is all very well for the man to whom pure adventure in merchandising is the zest of life, but not for the man whose sole purpose, aside from personal independence, is to provide an income for himself.

There happens to be, just now, a comparative scarcity of desirable retail locations, so the task of finding a store with proper merchandising potentialities is a more difficult one today than usual. It becomes doubly necessary, therefore, that the radio and appliance dealer guard himself against taking "any old thing" out of sheer discouragement. He must simply be more persistent in his search. A temptation in the solution of his store-locating problem will be the new taxpayers in outlying and newly developing residential neighborhoods which are bound to be one of the answers in the new construction program, to the store location needs of the retail trade generally. The dealer must keep in mind that, while a taxpayer property in an old and established retail section presents a worthwhile location opportunity, this is not necessarily true of a similar property in a newly initiated or "away-from-things" zone, where no active buying has yet developed.

The radio and appliance business has a specific characteristic that weighs heavily in the determination of store location, that is, that radios and appliances are merchandise for home installation and home use. (Automobile radios are only a specialty.) That being the case, the retail section in which the radio and appliance store is located must be one that serves a residential community. But it must be a sizeable residential community. A small neighborhood that easily supports a grocer may very well be too small to support a radio and appliance dealer, because, while people eat every day, they do not buy radios or toasters or pressure cookers every day.

Generally, it is good sense for the prospective radio and appliance dealer to look for a location in a section or along a street where housefurnishings are already being merchandised—a section containing stores selling furniture, draperies, linen goods, kitchenware and other housewares. A concentration of such stores constitutes a housewares shopping center to which housewives are accustomed to come for merchandise for home installation and use. This principle, however, does not rule out sections in which other types of stores are concentrated. It will frequently be found, for instance, that stores merchandising women's apparel tend to group themselves along a block or a couple of blocks. Now, quite obviously, there is no kinship between women's apparel and radios and appliances. But the fact remains that, even in the case of radios and appliances, and especially the latter, it is the woman of the family who does

(*Continued on page* 136)

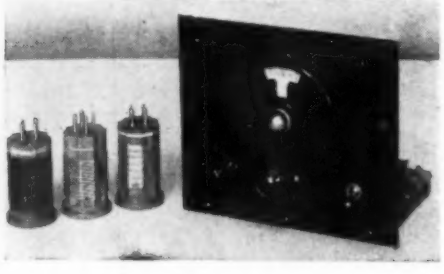
For the EXPERIMENTER

Although the recent survey conducted by Radio News indicated a predominance of servicemen and amateur readers, we found that many would like simple "how-to-do-it" articles. Accordingly we present this new department for the benefit of these readers.

SIMPLE ONE TUBE RECEIVER

One of the most useful pieces of equipment you can build, is a simple regenerative receiver. By the use of plug-in coils, practically all the most used frequencies may be covered. In addition, the receiver is handy to have around as an extra receiver. Many uses besides reception suggest themselves for this type of receiver and will be covered in later articles.

The receiver illustrated uses only one tube, a 1G6GT, and may be operated from a 1.5 volt "A" battery and 90 volts of "B." As this tube is, in reality, two tubes in one envelope, one section is used as a regenerative detector, while the other section serves as an audio amplifier. The detector portion is made regenerative by means of a feedback winding. Regeneration is controlled by means of a feedback condenser, C_3 (Fig. 1).



Front view of receiver.

The baseboard used is made of plywood and measures 5 by 7 inches. Any plywood or piece of smooth board at least ⅜ inches thick will serve as well. The panel is a piece of No. 16 gauge steel and measures 7 inches high by 8 inches in length.

Location of the various parts may be seen by examining the photographs. The coil and tube sockets are of the bakelite type, and are mounted above the baseboard on spacers made of ¾ inch lengths of ¼ inch outside diameter copper tubing, to allow the prongs to clear the baseboard.

For ease in tuning a *National* Type B dial is used. Any other smoothly operating dial may be substituted.

After the parts have been mounted, the wiring should be put in place. No. 14 tinned wire is used for wiring the r.f. portion of the circuit, consisting of the coil and two variable condensers. All other wiring is done with No. 22 pushback.

Freq. (kc.)	L_1	L_2
500-1300	175 t. #30 e. 2" long	28 t. #36 d.s.c.
1070-2200	81⅔ t. #28 e. 1⅞" long	16⅔ t. #36 d.s.c.
2000-4550	37⅔ t. #26 e. 1⅜" long	10⅔ t. #36 d.s.c.
4000-9100	17⅔ t. #22 Tinned 1½" long	5⅓ t. #36 d.s.c.
7300-18000	8⅔ t. #16 Tinned 1⅜" long	3⅔ t. #36 d.s.c.

L_2 is close wound ¼" from "cold" end of L_1. All windings in same direction. Lower end of L_2 goes to plate. Upper end of L_1 goes to grid.

The set of four coils for the range of 1070 to 18,000 kc. are available as Hammarlund kit No. SWK-4

Winding specifications for plug-in coils.

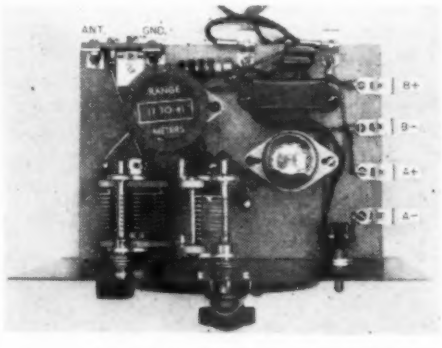
The resistor (R_2) across the secondary of the audio transformer and the .003 and .004 condensers (C_5 and C_6) are necessary to eliminate an audio howl when the receiver is on the verge of oscillation. This howl is characteristic of this type of receiver, and can be very annoying if not eliminated.

Specifications for the coils used for the various frequencies, are given in the accompanying table.

When wiring has been completed, "A" and "B" batteries should be connected, a coil for the desired frequency plugged in, and the receiver turned on. The regeneration condenser C_3 should be slowly advanced toward maximum capacity until the receiver just starts to oscillate. A soft "thud" will be heard as this point is reached. Oscillation may be detected by touching the stator plates of C_2 with the finger. If the receiver is oscillating, a click will be heard when these plates are touched.

Note that magnetic type headphones should be used with this receiver. Crystal headphones cannot be used.

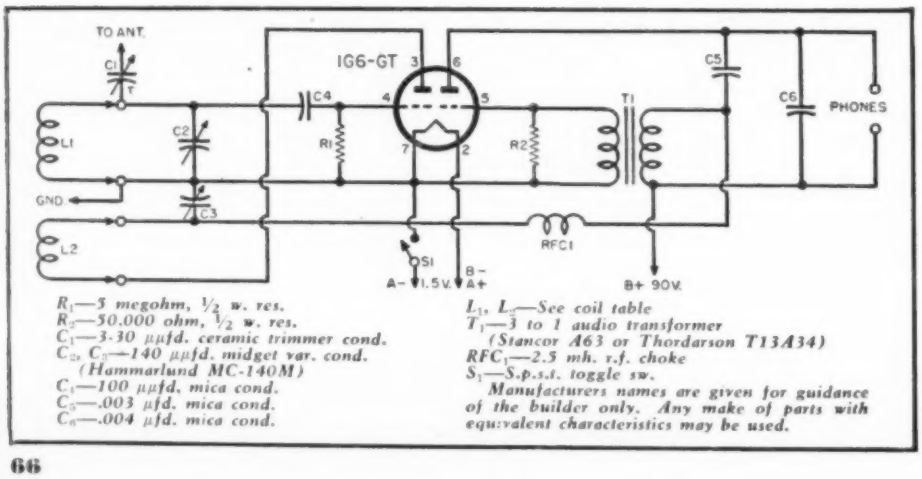
With an antenna connected, the receiver should be slowly tuned while oscillating weakly. A whistle will be heard as a station is approached. If this station is a code station the whistle will be broken into dots and dashes, and the regeneration condenser C_3 should be backed off until the receiver is just about to go out of oscillation. This is the most sensitive point for the reception of code signals. If the desired station is using phone, the regeneration should be adjusted until the receiver is just on the verge of oscillating. It will probably be necessary to retune slightly as the regeneration is adjusted.



Top of chassis view of receiver.

In general, it is desirable to use a long wire antenna, and a good ground with this type of receiver. As an antenna has resonant points at its fundamental frequency and harmonics, it tends to absorb energy from a regenerative receiver. These points cause dead spots in the tuning range of the receiver. The cure is to reduce the coupling of the antenna condenser C_1 until smooth operation is obtained over the entire range. If the dead spot occurs close to a popular frequency, it may be moved by shortening or lengthening the antenna.

Fig. 1. Schematic diagram of 1-tube regenerative type receiver.



R_1—3 megohm, ½ w. res.
R_2—30,000 ohm, ½ w. res.
C_1—3-30 μμfd. ceramic trimmer cond.
C_2, C_3—140 μμfd. midget var. cond. (Hammarlund MC-140M)
C_4—100 μμfd. mica cond.
C_5—.003 μfd. mica cond.
C_6—.004 μfd. mica cond.
L_1, L_2—See coil table
T_1—3 to 1 audio transformer (Stancor A63 or Thordarson T13A34)
RFC_1—2.5 mh. r.f. choke
S_1—S.p.s.t. toggle sw.

Manufacturers names are given for guidance of the builder only. Any make of parts with equivalent characteristics may be used.

LINE DROPPING RESISTORS

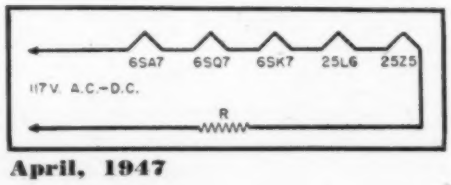
Experimenters will find when building a receiver or an electronic gadget of some type directly from a schematic diagram that specifications for component parts are usually given. However, there are many instances where the builder must figure out the resistance and wattage rating of some form of dropping resistor. This problem is simple.

Let us take, for example, a typical situation of determining the value of a line dropping resistor used in many a.c.-d.c. receivers. This resistor is placed in series with the heaters of all of the tubes and serves the purpose of dropping the voltage across the tube string to its proper value. This resistor may be in the form of a line cord resistor, ballast tube, or an actual resistor located within the receiver chassis. Regardless of which is used, the method of calculation will be the same. The total voltage drop in a series string must be equal to the line voltage, normally assumed to be 117 volts. Thus, the voltage drop across the resistor must be equal to this line voltage minus the voltage drop across all of the tubes.

Since all of the tubes are in series the total voltage necessary across the tube string would be the sum of the voltage drops of the tubes. To obtain the voltage drop for each tube, it is advisable to refer to the tube manual. In our example, let us assume that the tubes used in this receiver are a 6SA7, 6SQ7, 6SK7, 25L6 and a 25Z5. We see from the tube manual that the 6SA7, 6SQ7, and 6SK7 all have 6.3 volt heaters, while the 25L6 and the 25Z5 each have 25 volt heaters. The total drop across these tubes is therefore 68.9 volts. The dropping resistor must compensate for the difference between this voltage and that of the line (117 volts). In this case the correct value would be $117 - 68.9 = 48.1$ volts across the dropping resistor.

The next step is to determine the current flowing through the resistor. In general, all of the tube heaters in a series string carry the same current, so in checking your tube manual, you will find that all of these tubes have a heater current rating of .3 ampere. Knowing the voltage drop and current, the resistance may be easily determined by means of Ohm's Law ($R = E/I$) which states that the resistance (in ohms) is equal to the voltage drop (in volts) divided by the current (in amperes). In making this calculation you will find that the resistance of the dropping resistor will be $48.1/.3 = 160$ ohms.

Series heater string of a conventional five tube a.c.-d.c. receiver. Resistor, R, is known as a dropping resistor.

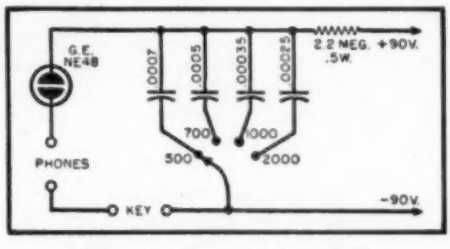


In addition to the ohmage of the resistor, its wattage rating must also be determined. The watts dissipated may be determined in any of three ways: (1) the square of the current (in amperes) x the resistance (in ohms); (2) the square of the voltage drop (in volts) / the resistance (in ohms); or (3) the current (in amperes) x the voltage drop (in volts). In the example given above, using method (1), the dissipation will be: $.3^2 \times 160 = 13.4$ watts. This wattage rating is not a standard value. It is customary to choose a resistor of the next highest standard rating. Do not, in any instance, use a resistor that is under the value determined by your calculations as the chances are that your resistor will burn up.

This is only a typical example. You will find dropping resistors in many forms used in electronic devices. The procedure for calculating these ratings will remain the same.

NEON TUBE OSCILLATOR

For code practice work and general audio testing, some form of audio oscillator is desirable. Many simple oscillators have been devised, but one of the simplest is the neon tube type. Only a source of "B" voltage, one resistor, and one condenser are required for an oscillator of this type. By means of a switching arrangement to change the value of the condenser, it is possible to vary the audio frequency between wide limits. Alternately, the



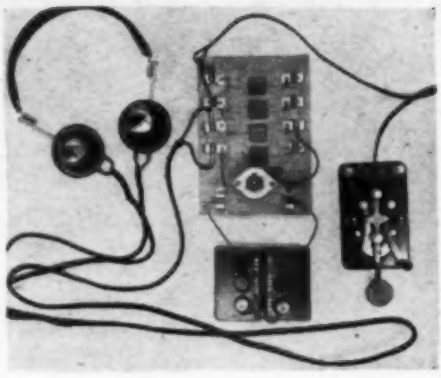
Schematic diagram of oscillator.

value of the resistor may be changed to achieve the same effect.

The entire unit is constructed on a 5" by 7" baseboard of plywood, with Fahnestock clips used for connections and frequency changing. The four mica condensers used for the various frequencies are mounted between a common bus and the clips. A flexible lead which may be clipped into any of the four clips, is used to select the desired tone.

Power for this unit may either be obtained from 90 volts of "B" batteries, or from the Versatile Power Supply shown on these pages.

The neon tube used is one of the bayonet base, ¼ watt type, which is furnished with no resistor in the base. In the event that this type is not available, the resistor normally included in the base must be removed. This may be easily accomplished by placing the base of the tube in hot water, until the cement which holds the glass in place has softened. The resistor may then be removed, and the leads from



Photograph clearly indicates construction of neon tube oscillator. The entire unit is built on a 5"x 7" plywood baseboard.

the tube resoldered to the base.

The socket used for the tube is of the double contact bayonet type, obtainable at either radio jobbers, or automobile supply stores.

With the values given in the diagram, the audio frequencies are approximately 500, 700, 1000, and 2000 cycles. Values intermediate between these may be obtained by the substitution of other condenser values.

VERSATILE POWER SUPPLY

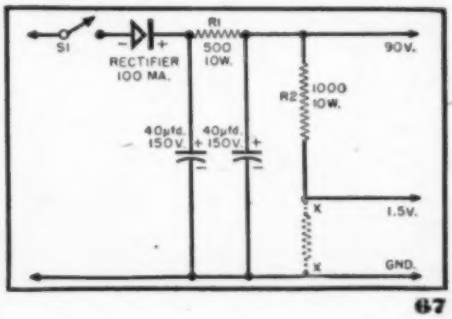
In reviewing the articles "A Simple One Tube Receiver" and "Neon Tube Oscillator" appearing in this department, you will notice that batteries were used to power these units. Batteries were suggested as being the simplest and most trouble-free method of operation. The power supply covered here can be used in place of the batteries suggested. We think because of the great number of units to which this power supply may be adapted in the future that the experimenter should build this piece of equipment even if it isn't used to power the one-tube receiver or the neon tube oscillator.

The use of the new selenium rectifier (replacing the conventional rectifier tube) makes such a supply extremely easy to build.

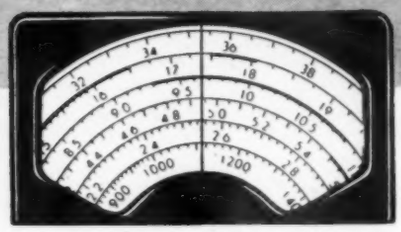
The power supply shown in the photograph and diagram has been designed particularly for use with the simple one-tube receiver appearing in this department. It consists of a 100 ma. selenium rectifier together with two 40 μfd., 150 v. electrolytic condensers, one 500 ohm, 10 w. resistor

(*Continued on page* 171)

Schematic diagram of versatile power supply. A selenium type rectifier is used in place of a conventional vacuum tube.



International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

THIS month we are pleased to dedicate the ISW Department to two European countries—Bulgaria in the South, and Finland in the far North.

Thanks to Rex Gillett, DX editor of *"Radio Call,"* South Australia, we pass along this information regarding radio in Bulgaria, as received by Mr. Gillett from *Radio Sofia:*

"Broadcasting in Bulgaria is the monopoly of the State. The whole radio service is owned and administered by the State under the name of the Bulgarian Broadcasting System. Broadcast band outlets are *Radio Sofia,* 100 kw., 650 kcs.; *Radio Stara Zagora,* 2 kw., 1402 kcs.; and *Radio Varna,* 2 kw., 1276 kcs.

"On short-wave, *Radio Sofia* uses 5 kw. on 7.660, while *Radio Rodina* on 9.350 uses the same power.

"Bulgaria has well over 200,000 registered receivers. Advertising on the air was discontinued some years ago. A decision to resume it has been made, however, and a special advertising service is now being organized.

"*Radio Sofia* publishes a magazine called 'Radio Pregled.' This publication gives programs of *Radio Sofia* and also those of Moscow, London, and Belgrade. It is sent abroad on request."

While complete current schedules of *Radio Sofia* are not at hand, *English* news is presented at 3:30 p.m.* daily over both the 9.350 and 7.660 frequencies, according to British monitors. The 9.350 frequency is heard in Canada around 12 midnight.

Here are a few facts about Bulgaria:

Bulgaria has an area of 42,808 square miles; it is bounded on the north by Rumania, on the west by Yugoslavia, on the south by Greece, on the east by the Black Sea, and on the southeast by Turkey. The 1940 population was 6,549,664.

Bulgaria's language is Slavonic. The state church is Greek Orthodox. Elementary education is obligatory from seven to 14 years of age. There is a state university in Sofia and the American College is located there.

Agriculture claims 78 per-cent of the population; principal crops are wheat, rye, barley, oats, corn, potatoes, and tobacco. Fruit is abundant. Normally, industrial plants and cultures, fruits, vegetables, and dairy products are exported in large quantities. The chief seaports are Varna and Burgas (Bourgas), which account for about 80 per-cent of the foreign trade.

* * *

Radio in Finland

Wolf von Harpe, Helsinki, has secured this information for us, direct from the Finland Broadcasting Corporation *(Suomen yleisradio)* in Helsinki:

Normal schedules of the Finnish short-wave transmitters are:

Helsinki—6.120, 10 kw., 11-11:15 p.m.; 12:20-5:40 a.m.; 5:50-7:10 a.m.; 10 a.m.-4 p.m.

Lahti—9.500, 15 kw., 11-11:35 p.m.; 12:05-1 a.m.; 3:50-7:10 a.m.; 10 a.m.-4 p.m.

Peri—15.190, 15. kw., 11-11:15 p.m.; 12:20-12:50 a.m.; 4-5:40 a.m.; 5:50-7:10 a.m.; 10 a.m.-4 p.m.

Helsinki—17.800, 1 kw., 12:45-1 a.m.; 1:50-7:10 a.m.; 10 a.m.-4 p.m.

In addition, *English* news is generally given around 7:15 a.m. on the 9.500 frequency, and around 7:15 or 7:25 p.m. on 15.190; other frequencies parallel these at times, irregularly.

Mr. von Harpe lists Finnish medium- and long-wave stations as:

Helsinki—1420 kcs., 10 kw. *Vaasa*—1320 kcs., 10 kw. *Joensuu*—310 kcs., 1 kw. *Kuopio*—527 kcs., 20 kw. *Pietarsaari*—1500 kcs., 1 kw. *Peri*—1429 kcs., 1 kw. *Tampere*—1522 kcs., 1 kw. *Turku*—895 kcs., 40 kw. *Lahti*—160 kcs., 150 kw., and *Oulu,* 433 kcs., 10 kw.

This northern European country has an area of 134,588 square miles. It is bounded on the north by Norway, on the east by Russia, on the south by the Gulf of Finland, and on the west by the Gulf of Bothnia, Sweden, and Norway. The 1942 population was listed at 3,887,217. Helsinki is the capital city.

The lake and canal waterways of Finland are navigable for 3000 miles. Notable are the mighty Imatra rapids of the river Vuokski, having in a channel about 25 yards wide an aggregate fall of about 75 feet in a distance of 1400 yards and a volume (the greatest in Europe) of between 480 and 700 cubic meters per second, discharging ultimately into Lake Ladoga.

Although extending far north into extremely cold latitudes, with rugged climate and topography, Finland is an agricultural nation. Lumber is the most important industry. Principal crops are rye, barley, oats, potatoes, and hay. Other chief industries in the order of their importance are paper and pulp; iron and mechanical products; textiles; leather, rubber and fur; and chemicals.

(*Continued on page* 106)

This neat s.w. Listening Post is that of a newcomer to the fraternity. Bill Cooley of Fairchance, Pennsylvania. Receiver is a Sky Champion with which Bill has picked up plenty of good contacts in the short time he has been DX-ing.

*All times herein are in American Eastern Standard Time (EST), 5 hours *behind* GMT, unless otherwise indicated.

Deluxe Amateur TRANSMITTER

By JAMES N. WHITAKER, W2BFB
Eng. Dept., Hammarlund Mfg. Co.

Part 1. Design data for a 1-kw. transmitter. The most practical circuits for amateur service are incorporated in building this unit.

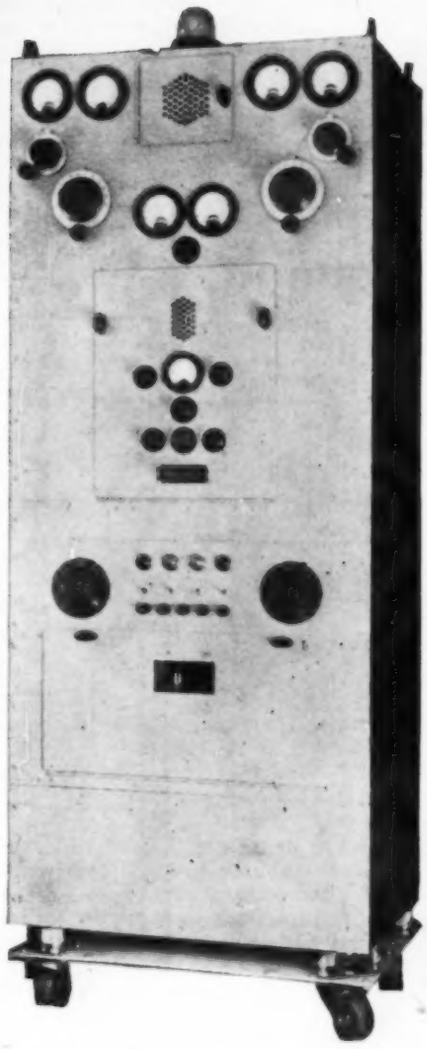


Fig. 1. Panel view of home-built 1-kilowatt transmitter. This unit may be operated entirely by the amateur from a remote position, or in the regular fashion if it is desired.

WITH the resumption of radio amateur activities following the conclusion of World War II, the amateur is confronted with a great variety of available component parts consisting of new items as well as war surplus materials from which he must select a few useful items to be incorporated in his postwar station. He has also been presented with a rather bewildering array of technical literature released as a result of the removal of wartime secrecy restrictions. These two factors coming along together as they do are quite bewildering to say the least and before starting out on a shopping expedition it will be wise for him to consider very carefully just what end result is desired. The cost of component parts on the surplus market is low enough to make possible the selection of high quality items which will permit the construction of equipment often dreamed about but seldom realized in amateur circles. A few of the most desirable features to be incorporated in a transmitter for amateur service can be roughly listed as follows:

1. *The radiated signal must be as pure as possible.* The a.c. ripple and spurious noise modulation must be below 1%. The harmonic content of the emitted carrier must be relatively low. There must be no radiations at spurious frequencies (parasitic oscillations, etc.) Modulation of the carrier must be linear and free from parasitic oscillations which so frequently are present during the modulation peaks.

2. *The p.a. efficiency must be high.* Since amateur transmitters are limited in power to 1000 watts of plate input to the final amplifier, considerable time should be allotted to obtaining the highest possible efficiency in this stage. This immediately rules out the typical "ham" method of operating the output tubes at considerably beyond the manufacturer's published ratings.

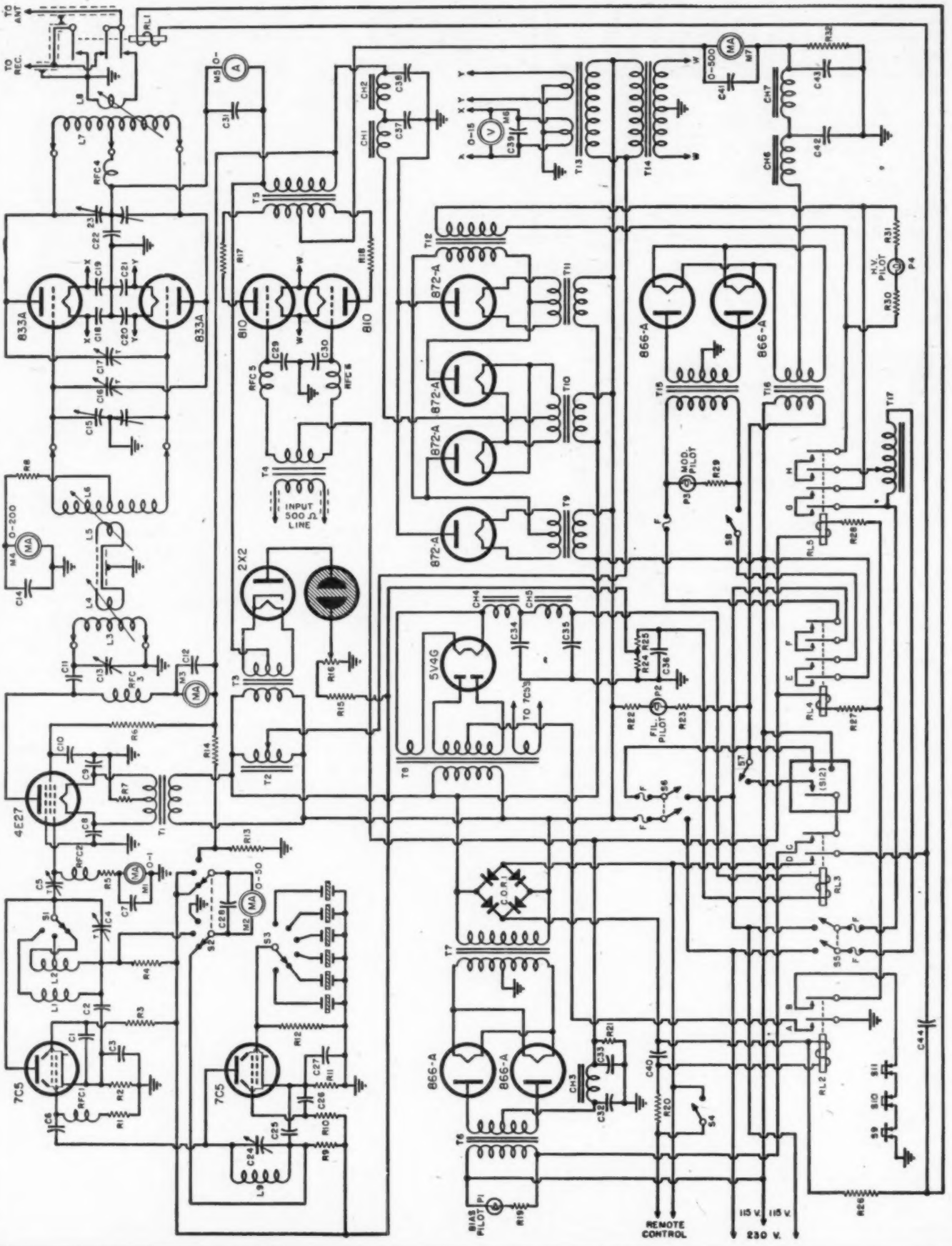
3. *The frequency must be stable.* Even a slow drift in one direction is likely to cause considerable annoyance not only to the receiving station where the receiver must be continually tuned to follow the transmitted signal, but also to other stations which might be receiving interference from the transmitter. To achieve real stability the old concept of a high-powered crystal controlled oscillator must be discarded for the more recent understanding of the prime reason for the use of crystals. They are a frequency stabilizing element rather than a source of power. The same is generally true of self-excited oscillators. Any oscillator will provide a maximum of stability only when it is supplying a minimum of power.

4. *The method of power control must be positive and properly sequenced.* This usually indicates the use of several relays, interconnected with each other in such a manner as to apply power to the various sections of the transmitter in a proper sequence for starting up the transmitter and for removing the power in an order not necessarily the reverse of the starting sequence, when shutting down the transmitter, as will be shown later.

5. The speech amplifier should be a separate unit and should not have a linear frequency characteristic. This may sound strange, but a careful analysis of the problem will disclose the truth of this statement. All modulation applied to the carrier tends to distribute the emitted power in the form of sideband energy. The entire audio frequency range is not required for good voice intelligibility. The more power used in needless sidebands the less power will be available for the necessary speech frequencies. The speech amplifier should, therefore, discriminate against frequencies below 200 cycles and above 3000 cycles. Such an amplifier will permit a higher average of modulation before the peaks of the voice frequencies cause serious over-modulation. The peaks in voice frequencies are generally in the form of high frequency transients against which such an amplifier will discriminate.

6. *A very definite and simple over-modulation indication must be provided.* The indicator must show any overmodulation peak no matter of how short duration rather than the average modulation. Overmodulation peaks are the cause of serious sideband "splatter" and contribute greatly to the interference often experienced in nearby broadcast receivers. The overmodula-

Fig. 2. Complete schematic diagram of the 1-kw. deluxe transmitter. Outstanding features are a voltage doubler final amplifier supply, the use of a copper oxide rectifier to supply d.c. for operation of relays, a positive overmodulation indicator, and control of input power. Parts list is shown on page 71.



tion indicator should provide a positive indication of overmodulation regardless of the power used, and should not require adjustment when the power is increased or decreased.

7. *The transmitter should not be unnecessarily large.* Compactness is essential not only from the standpoint of the conservation of space but also for the purpose of obtaining the shortest possible electrical connections between components within the equipment.

8. *Shielding and isolation of circuits.* All r.f. sections should be carefully and completely shielded to prevent spurious radiations and to prevent reaction between the various circuits within the transmitter. It is impossible to overstress the importance of complete isolation of circuits in a transmitter. Academically, perfect isolation of circuits can probably never be realized, but the careful use of shielding and r.f. bypassing and filtering will result in practical perfection along these lines. In any event, the isolation of circuits should be carried out to the extent that no spurious oscillations will occur in any circuit or combination of circuits during normal operation, or in the event of failure of the oscillator.

A solid ground connection between units is required, and all bypass connections should be made directly to the chassis at the nearest possible point as well as to the running ground. Although the base metal of the chassis may be steel or other relatively low conducting material, the mass of the chassis will provide a lower resistance path than a copper conductor of convenient size. It is wise to use both a running ground and chassis connection, or a chassis connection and a running ground between chassis. In most instances a running ground will offer little if any improvement when the chassis is used for a ground connection, and all chassis are bonded together.

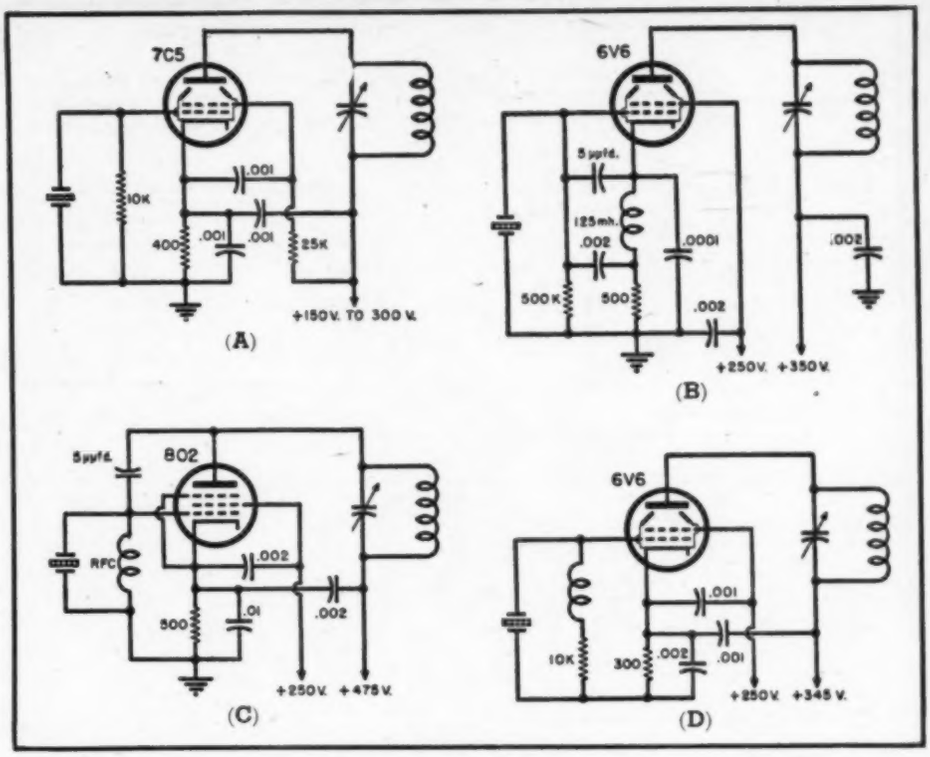


Fig. 3. Schematic diagram of several oscillators that were tried. Circuit shown in (A) proved most satisfactory and was the one finally adopted. Circuits (B), (C), and (D) could be used. The advantages and disadvantages of each are covered in text.

With these eight requirements in mind, the writer set out to design and construct the transmitter to be described. The over-all operation and the results obtained have proven how very worthwhile it is to allot an appreciable amount of time to the careful planning of the transmitter before parts are purchased and the actual construction is started.

The transmitter will be described briefly as a composite unit followed by specific descriptions of each section and will include reasons for the selection of the particular system or circuit used as well as other suitable circuits which may be substituted. It

Complete parts list for schematic diagram appearing on opposite page.

R_1, R_5—250,000 ohm, 1 w. metalized res.
R_2, R_{11}—400 ohm, 1 w. metalized res.
R_3, R_{10}—25,000 ohm, 1 w. metalized res.
R_4, R_9—50 ohm, 1 w. metalized res.
R_6—100,000 ohm, 25 w. w.w. res.
R_7—1200 ohm, 100 w. w.w. res.
R_8—3000 ohm, 100 w. w.w. res.
R_{12}—10,000 ohm, 1 w. metalized res.
R_{13}—400 ohm, 25 w. w.w. res.
R_{14}, R_{15}—Four 25,000 ohm, 100 w. w.w. res. in series
R_{16}—100,000 ohm, 1 w. metalized res.
R_{16}—50,000 ohm pot.
R_{17}, R_{18}—50 ohm, 10 w. w.w. res.
R_{19}, R_{22}, R_{23}, R_{29}, R_{30}, R_{31}—500 ohm, 5 w. w.w. res.
R_{20}—800 ohm, 10 w. w.w. res.
R_{21}—250 ohm, 100 w. w.w. res.
R_{24}, R_{25}—10,000 ohm, 20 w. w.w. res.
R_{26}, R_{27}, R_{28}—700 ohm, 10 w. w.w. res.
C_1, C_2, C_3, C_8, C_9, C_{14}, C_{25}, C_{26}, C_{27}—.001 μfd., 600 v. mica cond.
C_4, C_{24}—30 μμfd. midget var. cond.
C_5—15 μμfd. midget var. cond.
C_6—.0001 μfd., 600 v. mica cond.
C_7, C_{12}, C_{28}, C_{30}, C_{41}—.01 μfd., 600 v. mica cond.
C_{10}—.001 μfd., 5000 v. mica cond.
C_{11}, C_{22}—.0001 μfd., 10,000 v. mica cond.
C_{13}—50 μμfd. var. tuning cond.
C_{15}—50 μμfd. (per section) dual tuning cond.
C_{16}, C_{17}—15 μμfd. neutralizing cond.
C_{18}, C_{19}, C_{20}, C_{21}—.001 μfd., 2500 v. mica cond.
C_{23}—40 μμfd. (per section) dual tuning cond., spacing 15,000 v.
C_{29}, C_{36}—.0001 μfd., 2500 v. mica cond.
C_{31}—.01 μfd., 2500 v. mica cond.
C_{32}—4 μfd., 600 v. elec. cond.
C_{33}—Three 125 μfd., 150 v. dry elec. cond. in parallel
C_{34}, C_{35}—3 μfd., 600 v. Dykanol or Pyranol cond.
C_{36}—6 μfd., 600 v. Dykanol or Pyranol cond.
C_{37}—4 μfd., 3000 v. Dykanol or Pyranol cond.
C_{38}—Three 4 μfd., 3000 v. Dykanol or Pyranol cond. in parallel
C_{40}, C_{44}—8 μfd., 300 v. dry elec. cond.
C_{42}—4 μfd., 3000 v. Pyranol cond. (General Electric)
C_{43}—8 μfd., 3000 v. Pyranol cond. (General Electric)
T_1—Fil. trans. 115 v. to 5 v. @ 10 amps. c.t.
T_2—Variac (General Radio 200B)
T_3—Fil. trans. 115 v. to 2.5 v. @ 2 amps. c.t., 10,000 v. insulation
T_4—500 ohm line to class "B" grids input trans.
T_5—Mod. trans. 750 w., .5 db. from 100 to 4000 cycles
T_6—Special bias trans. 115 v. pri. to 110-0-110 v. @ .3 amp.
T_7—Trans. 110 v. a.c. to 2.5 v. @ 10 amps. c.t., 2000 v. insulation
T_8—Low voltage power trans. 115 v. pri., 475-0-475 v. @ 200 ma.; 6.3 v. @ 3 amps.; 5 v. @ 3 amps.
T_9, T_{10}, T_{11}—Fil. trans. 115 v. to 5 v. @ 20 amps., 15,000 v. insulation
T_{12}—Pole trans. 220 v. to 2200 v. 2 kva.
T_{13}—Fil. trans. 115 v. pri., 10 v. @ 10 amps. c.t.; 10 v. @ 10 amps. c.t.
T_{14}—Fil. trans. 115 v. to 10 v. @ 10 amps. c.t.
T_{15}—Plate trans. 115 v. to 2000-0-2000, 5 kva.
T_{16}—Fil. trans. 115 v. to 2.5 v. @ 10 amps. c.t., 15,000 v. insulation
T_{17}—Variac, 100-200 v. @ 9 amps.
P_1, P_2, P_3, P_4—6 w. @ 110 v. pilot lamps
L_1—28 mc. tank coil wound on 1" form
L_2—14 mc., tap for 21 mc., tank coil wound on 1" form
L_3—Plug-in tank coil (3 used, 28, 21, and 14 mc.)
L_4, L_{10}—2 t. coupling link
L_5—Plug-in grid coil (3 used, 28, 21, and 14 mc.)
L_7—Plug-in plate tank coil (3 used, 28, 21, and 14 mc.)
L_8—Var. output coupling link
L_9—7 mc. osc. coil wound on 1" form
RL_1—D.p.d.t., ant. relay, 110 v. a.c. coil
RL_2, RL_3—D.p.s.t. normally open relay, 28 v. d.c. coil
RL_4, RL_5—4 p.s.t. normally open relay, 110 v. a.c. coil
C.O.R_1—Full-wave copper oxide rect., 1 amp.
CH_1—3-8 hy., 300 ma. swinging choke (25 ohms d.c.)
CH_2—18 hy., 300 ma. filter choke (50 ohms d.c.)
CH_3—8 hy., 300 ma. filter choke
CH_4, CH_5—14 hy., 100 ma. filter choke
CH_6—8 hy., 600 ma. filter choke
CH_7—16 hy., 600 ma. filter choke
RFC_1, RFC_2—2½ mh. pi-wound r.f. choke
RFC_3—2½ mh., 500 ma. pi-wound choke
RFC_4, RFC_5, RFC_6—300 ma. pi-wound r.f. choke
S_1—S.p. 3 pos. sw. ceramic insulated
S_2—D.p. 3 pos. sw. ceramic insulated
S_3—S.p. 6 pos. sw. ceramic insulated
S_4, S_7, S_8—S.p.s.t. toggle sw., 25 amps.
S_5, S_6—D.p.s.t. toggle sw., 25 amps.
S_9, S_{10}, S_{11}—S.p.s.t. interlock sw., normally open
S_{12}—Motor driven time delay sw. set for 30 sec. delay
M_1—0-1 ma. meter 2½" bakelite case
M_2—0-50 ma. meter 3½" bakelite case
M_3—0-250 ma. meter 3½" bakelite case
M_4—0-200 ma. meter 3½" bakelite case
M_5—0-1 amp. meter 3½" bakelite case
M_6—0-15 v. a.c. meter 3½" bakelite case
M_7—0-500 ma. meter 3½" bakelite case
2—7C5 tubes
1—4E27 tube
2—833A tubes
2—810 tubes
1—5V4G tube
4—872A tubes
4—866A/866 tubes

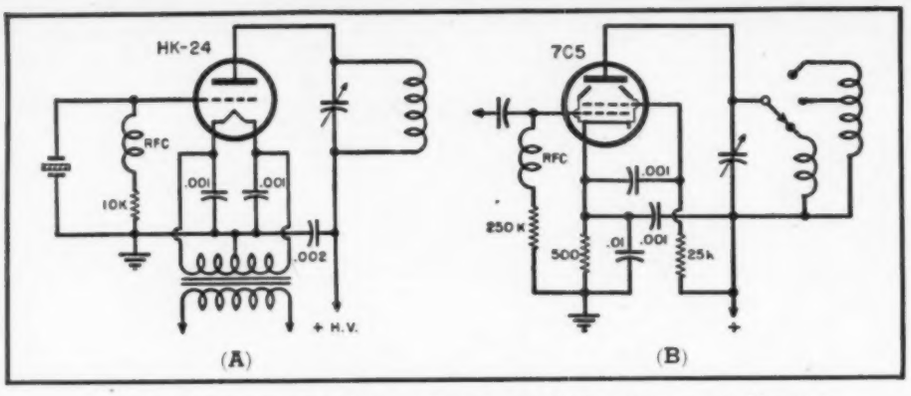


Fig. 4. (A) High powered triode oscillator capable of outputs up to 30 watts. (B) The bandswitching frequency multiplier used to drive the 4E27 buffer stage.

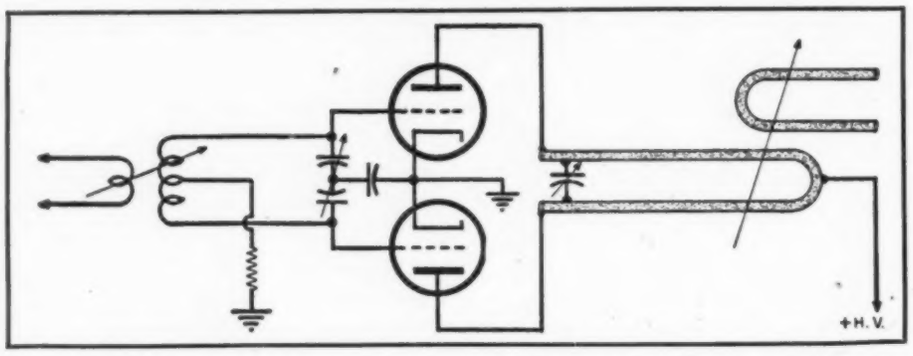


Fig. 5. Schematic diagram of a frequency multiplier system which will provide odd harmonic outputs. It is adaptable to high and ultra-high frequency circuits.

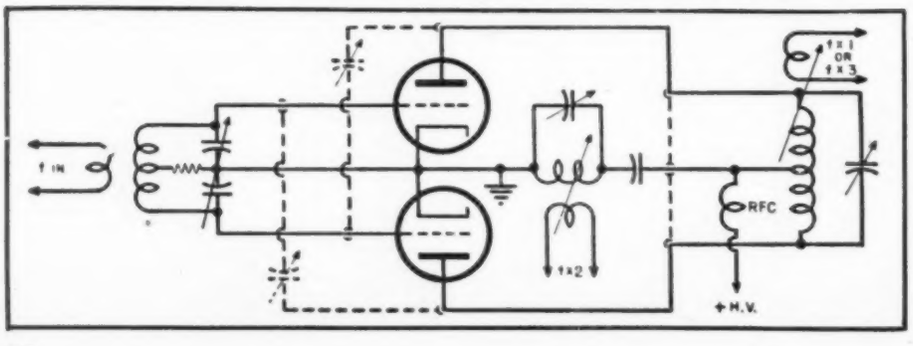
is hoped to thereby indicate possible modifications of the described setup which may better suit the particular needs of the individual who wishes to build a similar transmitter, and to provide a practical guide for the proper construction of any transmitter, regardless of power, up to the maximum power permitted for amateur use. This transmitter is shown schematically in Fig. 2.

The transmitter consists of a 7C5 crystal-controlled oscillator operating in the 7 mc. band, the 7C5 frequency multiplier, a 4E27 amplifier, and a final amplifier consisting of two 833A tubes in push-pull, modulated by two 810 tubes in class "B." Separate power supplies are provided for the oscillator and multiplier stages, the two amplifier stages and for the class "B" modulator.

A bias supply provides the negative grid bias for the class "B" modulator tubes as well as power for some of the control relays. The remote control and antenna changeover relays receive their power from a disc type copper oxide rectifier. A small variac is used for the adjustment of the filament supply for the modulator and power amplifier tubes and a large variac is used for the adjustment of the power input to the final and intermediate amplifier stages.

The speech amplifier is a separate unit mounted on the operating table and connected to the modulator unit through a 500 ohm shielded line. The transmitter output circuit is designed to operate into a large size (RG-14U) 52 ohm coaxial cable. The antenna changeover relay is mounted in the transmitter near the output coupling link and a small coaxial cable connector is mounted on the transmitter for connecting the antenna to the receiver.

Fig. 6. Schematic diagram of modified version of unit shown in Fig. 5. This system provides outputs at 1, 2, and 3 times the input frequency. It is a combination of a push-pull amplifier or push-pull tripler, and the rare push-push doubler.



The Oscillator

During the past several years it has been the writer's good fortune to have the opportunity of investigating oscillator circuits too numerous to mention. Each circuit has been carefully analyzed and data taken on output power, frequency stability, crystal current, etc. Each circuit was found to possess advantages and disadvantages. Any circuit used represents a compromise of some sort. The problem resolves itself into the selection of the most favorable compromise for the application in mind. In order to make an intelligent selection, the requirements must be studied carefully. In this case the requirements were briefly as follows:

1. The oscillator must be stable and free from self-oscillation when the crystal is removed or when the crystal is in place but ceases to oscillate.

2. The power required from the crystal must be so small that there will be negligible internal heating of the crystal. The r.f. current through the crystal must be as low as possible and must not exceed 10 ma. of r.f. current under normal operating conditions and 25 ma. under any condition. (The r.f. current through the crystal must not be confused with the d.c. grid current of the oscillator tube although the two may bear some relationship). The r.f. potential developed across the crystal must never reach a value sufficient to produce a corona discharge or any burning of the crystal or the electrodes.

3. The crystal must start oscillating immediately upon the application of power to the oscillator plate and screen circuits. There must be no sluggishness in the crystal action. (A good test for sluggishness is to key the oscillator circuit at high speed with the keying arranged to open and close the cathode-to-ground circuit of the oscillator tube.)

4. The tuning of the oscillator circuits must not be critical and the oscillator must not be affected materially by the loading produced by the following stage whether or not the following stage is operating properly.

5. The oscillator must deliver sufficient power to drive a multiplier stage and at the same time fulfill the requirements set forth in the preceding paragraph.

A careful analysis of all circuits tested indicated that the most satisfactory circuit was one that was developed early in 1941 and which is shown schematically in Fig. 3A. In this circuit a 7C5LT beam tube is used in a more or less conventional crystal oscillator circuit. A 6V6 tube may be used in the same circuit with almost, but not quite, as good results. The new 50B5 tube will perform as well as or possibly better than the 7C5 tube and is useful in connection with a 50B5 multiplier tube where it is desirable to connect the heaters in series for operation from a 110 volt power line to eliminate a filament transformer. (If this is done a 100 ohm, 10 watt re-

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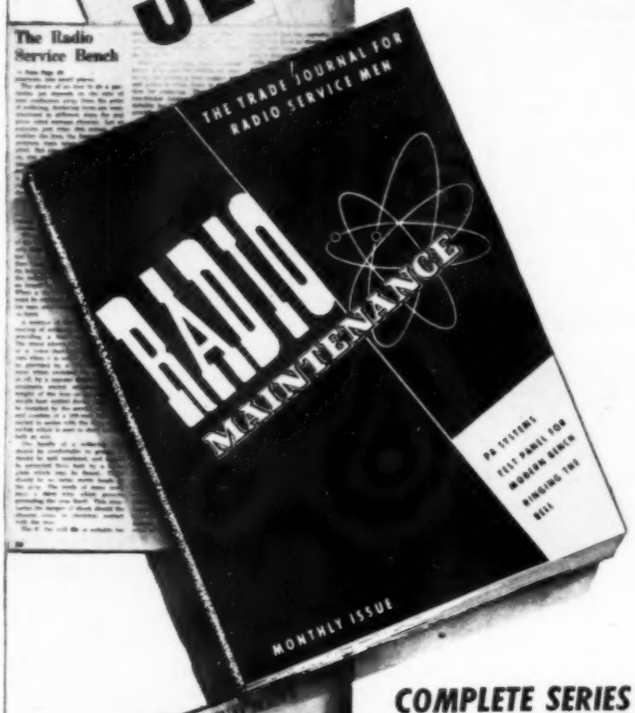

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sistor should be connected in series with the tube heaters). A miniature type beam tube such as the 50B5 is undoubtedly superior as an oscillator tube in this circuit where it is desired to use crystals having a fundamental frequency above 8 mc.

A 400 ohm cathode biasing resistor bypassed by a .001 μfd. mica capacitor is connected between the oscillator cathode and ground to provide a normal bias between the grid and cathode of the oscillator tube. With this arrangement no damage can occur to the tube when the excitation is removed and also the crystal is not required to supply the full operating bias for the tube. A 10,000 ohm, non-inductive resistor is connected between the oscillator grid and ground. This resistor performs two functions. One function of this resistor is to provide a path from grid to ground. The other function is to provide a relatively low resistance load for the crystal. This load prevents the r.f. potential across the crystal from reaching a high value. A resistor of 5000 ohms may also be used with good results in many cases but 10,000 ohms seems to be the best value for positive operation.

The plate and screen potentials are obtained from a 150 or 300 volt power supply depending upon the power required from the oscillator. It is desirable, although not necessary, to regulate this potential. Slightly greater stability will be realized if this supply is regulated. Sufficient regulation may be obtained by the use of an OD3 regulator tube for 150 volt operation, or two OD3 tubes in series for 300 volt operation.

Note that both the screen grid and the plate tank circuits are bypassed directly to the cathode of the oscillator tube. Also note that the plate tank tuning capacitor is connected directly across the oscillator coil, without a series blocking capacitor. These are two important features.

If the screen and plate tank circuit bypass capacitors are connected to ground instead of to the cathode, there is a chance of regeneration and even of self-oscillation if the cathode bypassing capacitor is faulty or if the leads in the cathode-to-ground circuit are not very short.

The positive potential is applied to the screen grid of the oscillator tube through a 25,000 ohm series dropping resistor.

In normal operation, the r.f. current through the crystal is somewhat less than 1 ma., and never exceeds 15 ma. under any conditions, even with a 300 volt plate and screen supply. With a 150 volt plate and screen supply, the normal r.f. current through the crystal is practically unmeasurable, and does not exceed 10 ma. under any condition of tuning.

The oscillator will deliver over 5 watts of power to the multiplier stage when a 300 volt supply is used for the plate and screen potentials, and over 2 watts when a plate supply of 150 volts is used.

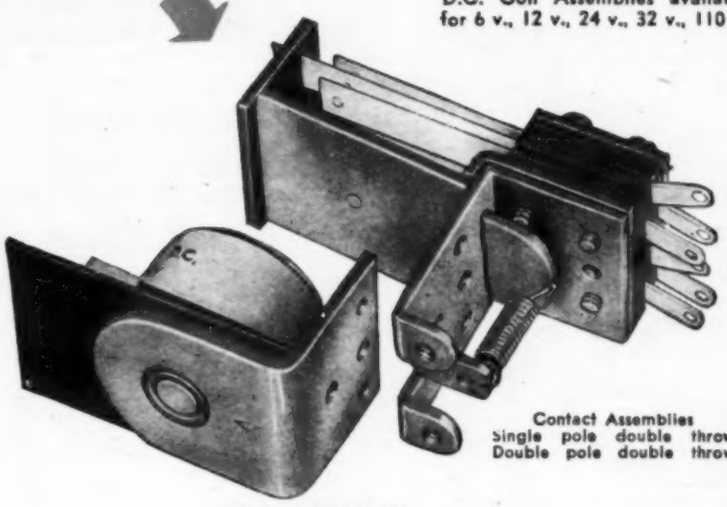
New! Series 200

A RELAY BY GUARDIAN with Interchangeable Coils

BUILT IN TWO PARTS

A.C. Coil Assemblies available for 6 v., 12 v., 24 v., 115 v.
D.C. Coil Assemblies available for 6 v., 12 v., 24 v., 32 v., 110 v.

★Two basic parts—a coil assembly and a contact assembly—comprise this simple, yet versatile relay. The coil assembly consists of the coil and field piece. The contact assembly consists of switch blades, armature, return spring, and mounting bracket. The coil and contact assembly are easily aligned by two locator pins on the back end of the contact assembly which fit into two holes on the coil assembly. They are then rigidly held together with the two screws and lock washers. Assembly takes only a few seconds and requires no adjustment on factory built units.



Contact Assemblies
Single pole double throw
Double pole double throw

SERIES 200 RELAY

On Sale at Your Nearest Jobber NOW!

See it today! . . . this amazing new relay with interchangeable coils. See how you can operate it on any of nine different a-c or d-c voltages —simply by changing the coil. Ideal for experimenters, inventors, engineers.

TWO CONTACT ASSEMBLIES

The Series 200 is available with a single pole double throw, or a double pole double throw contact assembly. In addition, a set of Series 200 Contact Switch Parts, which you can buy separately, enables you to build dozens of other combinations. Instructions in each box.

NINE COIL ASSEMBLIES

Four a-c coils and five d-c coils are available. Interchangeability of coils enables you to operate the Series 200 relay on one voltage or current and change it over to operate on another type simply by changing coils.

Your jobber has this sensational new relay on sale now. Ask him about it.
Or write for descriptive bulletin.

You are invited to visit Guardian's Booth, No. 51, Radio Parts and Electronic Equipment Trade Show, May 13-16, Stevens Hotel, Chicago

GUARDIAN ELECTRIC

1630-D W. WALNUT STREET CHICAGO 12, ILLINOIS

A COMPLETE LINE OF RELAYS SERVING AMERICAN INDUSTRY

With a plate potential of 350 volts, and an r.f. load of 6 watts, the plate current is 37 ma., the screen grid current is 4 ma., the r.f. crystal current is approximately 1 ma., and the plate efficiency is approximately 46%.

Other Oscillators

For those wishing to use other oscillator circuits, the following circuits and operating data is offered.

Harmonic Oscillator. (Fig. 3B)

This is one of the many versions of the controlled oscillator type, where the circuit is either self-oscillating or where the regeneration is almost sufficient to produce self-oscillations, and where output is obtained at multiples of the crystal frequency. There are so many versions of this type of oscillator that space does not permit the inclusion of all data and other pertinent information. The circuit shown was selected because of its general performance and stability, together with a relatively safe value of crystal current. The output will vary between 2 and 5 watts, depending upon the output frequency.

With a 3.5 mc. crystal, any multiple of the crystal frequency up to 21 mc. may be obtained with an output power of 2 watts or over. The plate current will range from 20 ma. at 7 mc. to 40 ma. at 21 mc., and the r.f. crystal current will range from 25 ma. at 7 mc. to 38 ma. at 21 mc.

When testing oscillator circuits of this or any other type employing regeneration a 60 ma. pilot bulb should be connected in the crystal-to-ground circuit as a protection against accidental overloading of the crystal.

802 Crystal Oscillator. (Fig. 3C)

One of the more popular crystal oscillators utilizes the 802 type tube. If properly shielded, this oscillator provides a relatively high output with low crystal current. The regeneration within the tube is of such a low value that an external feedback capacitor is required to produce and sustain oscillations. Care must be exercised in the selection of the feedback capacitor, as too much feedback will produce high r.f. crystal currents which may damage the crystal.

With a plate potential of 475 volts and a screen grid potential of 250 volts, and an r.f. load of 8 watts, (3.5 mc. crystal, and output at the fundamental frequency) the plate current will be 34 ma., the screen grid current 15 ma., and the r.f. crystal current will be 6 ma. The plate efficiency under these conditions is approximately 49%.

6V6 Oscillator. (Fig. 3D)

Using a 6V6 oscillator in the circuit shown in Fig. 3D, the following data was obtained: (3.5 mc. operation)

With a plate potential of 345 volts, and a screen potential of 250 volts, the plate current is 45 ma., the screen current is 5 ma., and the r.f. crystal current is 1 ma. with a 6 watt r.f.

(*Continued on page* 154)

★ First to comply with N.E.M.A. and Underwriters' specifications for industrial equipment.

★ Rugged insulating barriers prevent flashover and arcing in humid and dusty industrial applications.

★ Reversible binding screw terminals simplify wiring and maintenance.

★ Cloverleaf contacts . . . four full length lines of contact with each tube pin.

AMPHENOL ELECTRONIC TUBE SOCKETS

designed for INDUSTRIAL *applications*

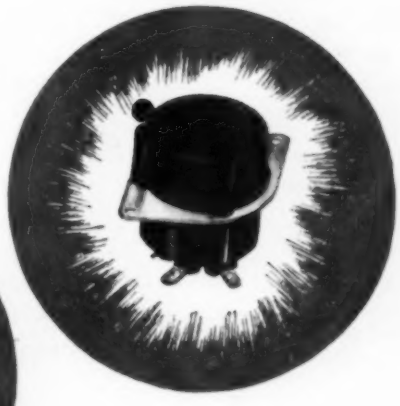
Amphenol Electronic Tube Sockets are specially designed for industrial applications. Ruggedly built for utmost dependability and peak performance, they were the first industrial tube sockets to comply with N.E.M.A. and Underwriters' specifications for industrial equipment.

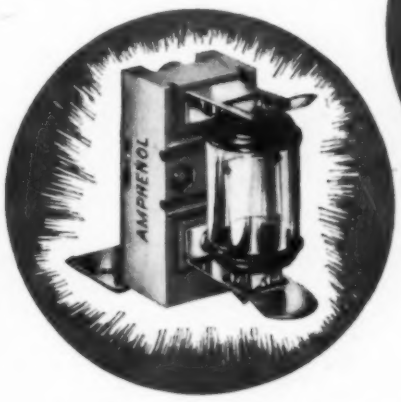
Amphenol sockets are molded of melamine resin or bakelite for strength as well as high arc-resistance and reduced carbon tracking. Utilization of the latest developments in spring bronze has insured the highest degree of contact conductivity and long spring life. Maximum spacing between contacts and chassis is maintained. Heavy insulating barriers prevent flashover between contacts under the adverse conditions found in industrial usage. Screw type terminals provide for quick connect and disconnect, ideal for testing and replacement. No soldering is required.

Amphenol sockets are available in types for practically all industrial electronic tubes. Write today for complete information.

AMPHENOL

AMERICAN PHENOLIC CORPORATION
1830 SOUTH FIFTY-FOURTH AVENUE
CHICAGO 50, ILLINOIS





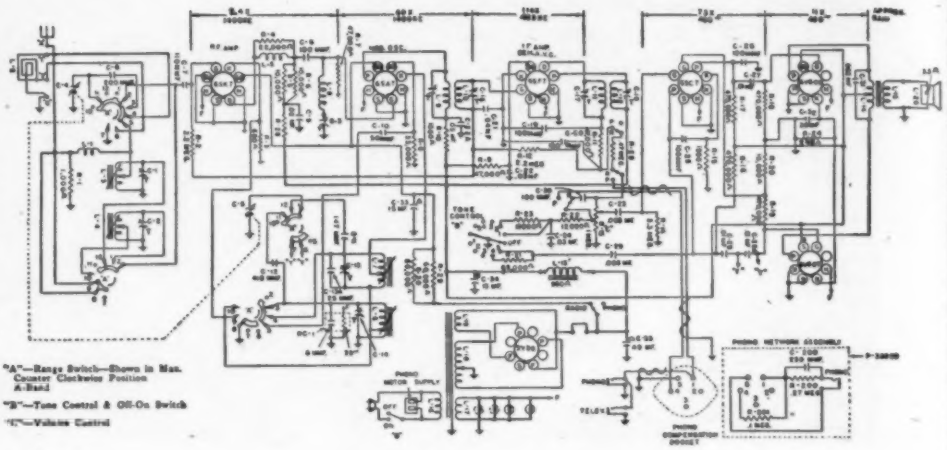
A few of Amphenol's complete line of industrial tube sockets are illustrated

COAXIAL CABLES AND CONNECTORS • INDUSTRIAL CONNECTORS, FITTINGS AND CONDUIT • ANTENNAS • RADIO COMPONENTS • PLASTICS FOR ELECTRONICS

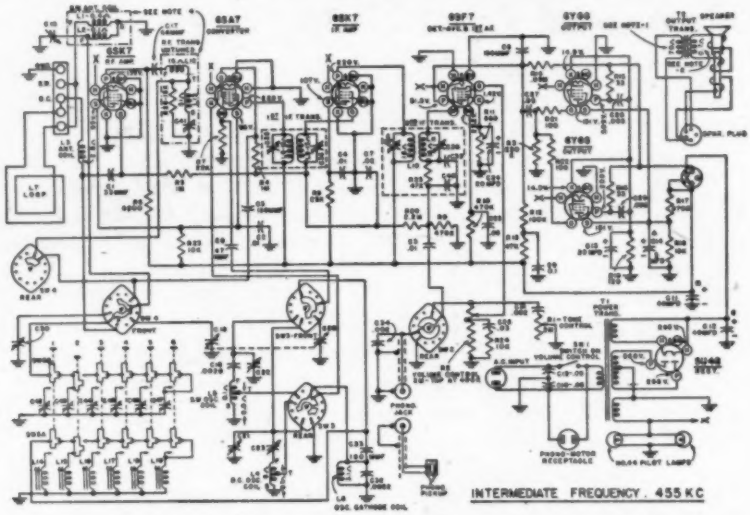
the RN CIRCUIT PAGE

(FOR PARTS LISTS SEE PAGE 92)

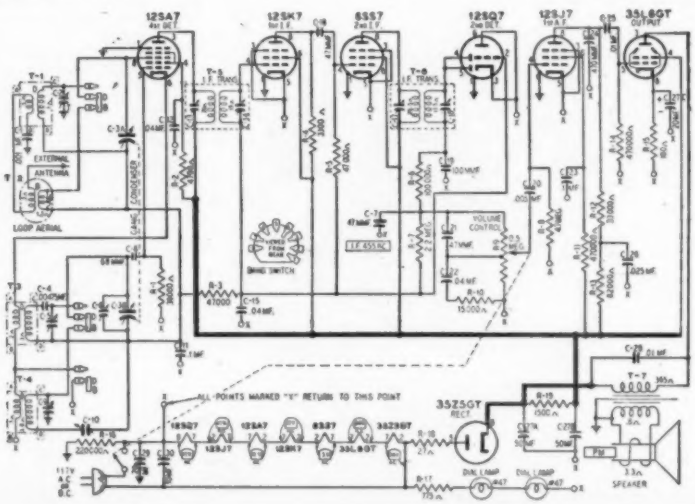
RADIO NEWS, APRIL, 1947 STROMBERG-CARLSON MODELS 1020, 1120, SERIES 10



RADIO NEWS, APRIL, 1947 WESTINGHOUSE MODELS H-104, H-105, H-107, H-108

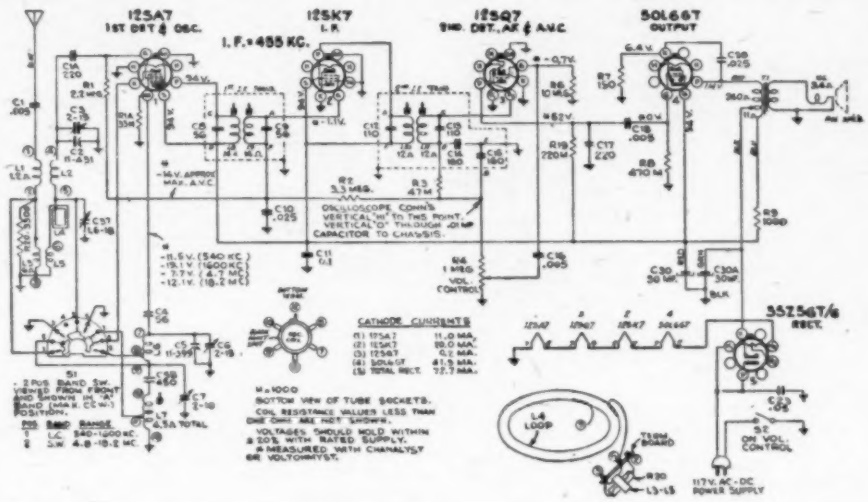


RADIO NEWS, APRIL, 1947 TRUETONE MODEL D2624

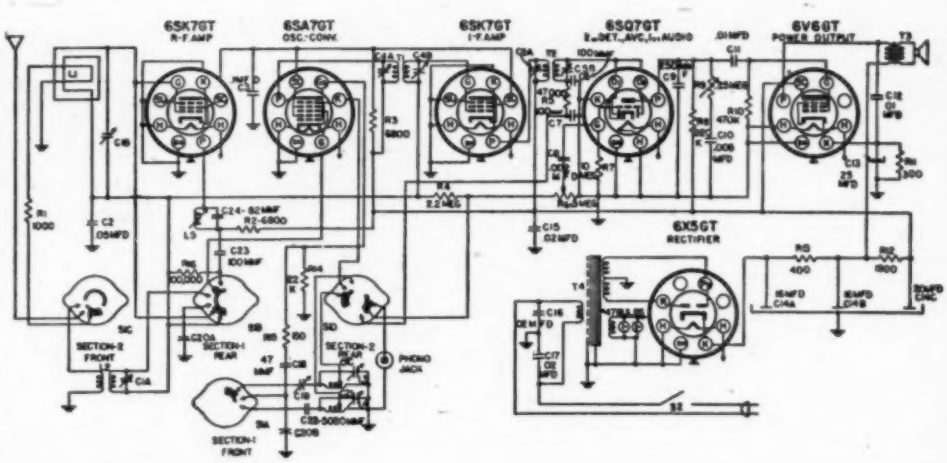


Here, and on following pages, are circuit diagrams and parts lists of many new postwar radio receivers. Radio News will bring to you other circuits as quickly as possible after we receive them from manufacturers.

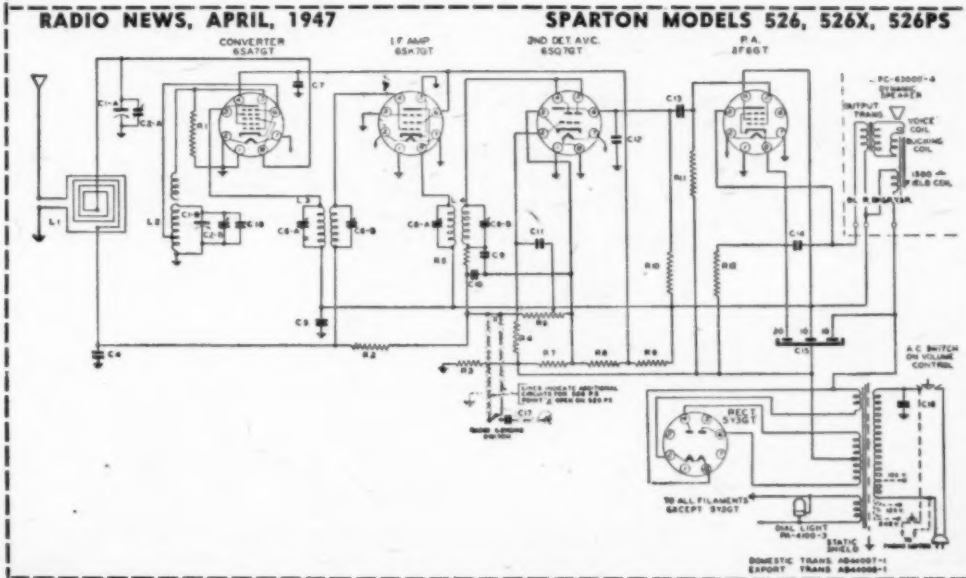
RADIO NEWS, APRIL, 1947 — **RADIOLA MODELS 61-6, 61-7**



RADIO NEWS, APRIL, 1947 — **AIR KING MODEL 4604D**



RADIO NEWS, APRIL, 1947 — **SPARTON MODELS 526, 526X, 526PS**

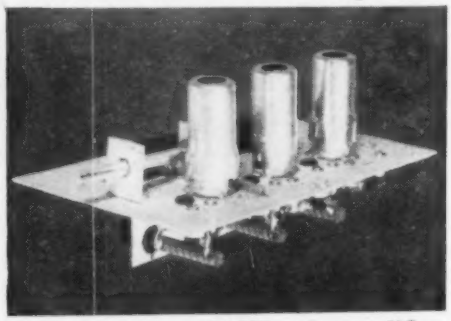


What's New in Radio

NEW FM TUNER

Radio Tuning Devices Co. of Stamford, Conn, has recently introduced a new FM tuner which is designed to provide complete coverage of the new FM band from 88-108 mc.

This unit carries a tube complement



consisting of a 6AK5 r.f. amplifier, 6AG5 mixer and a 6C4 oscillator.

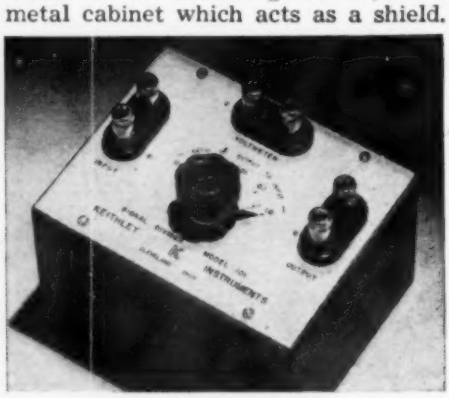
The company has also announced the production of a combination AM-FM tuner which, in addition to the above, also covers the broadcast band frequencies from 535 to 1620 kc. The separate 6SA7 converter used on this model permits bandswitching at the intermediate frequencies.

Full details on these tuners may be secured by writing the company direct. Address your requests to *Radio Tuning Devices Co.*, Wood Ridge Drive, Stamford, Conn.

SIGNAL DIVIDER

Keithley Instruments of Cleveland, Ohio has announced their new Model 101 "Signal Divider," an attenuator designed to provide the low level input signals used in testing high gain amplifiers. While ordinary signal sources have outputs which can be varied to a minimum of about 0.1 volt, the "Signal Divider" is used to extend the range downward and attentuates in decade steps.

The instrument, a resistance potentiometer with one side grounded, has a metal cabinet which acts as a shield.



Input and output terminals and a switch knob for setting the ratio are provided on the panel. The voltmeter terminals, connected in parallel with the input, permit the signal to be measured at high level by an insensitive voltmeter, and at the impedance level of the output impedance of the signal generator. The use of the voltmeter independent of the "Signal Divider" provides flexibility in permitting the meter to be used for more than one function.

For further information on the Model 101 "Signal Divider," write to *Keithley Instruments*, 1508 Crawford Road, Cleveland, Ohio.

FREQUENCY STANDARD

The Hammarlund Mfg. Co., Inc., has recently announced their new FS-135-C Frequency Standard which, when built into a receiver, makes the receiver an extremely accurate frequency meter, according to the manufacturer.

The unit is made up of an unusual circuit and a special silver-plated, spring suspended 100 kc. crystal which, when connected in the receiver, will generate marker signals every 100 kc. over the entire range of the receiver. Variations of the crystal frequency so that the marker signal may be adjusted for zero beating with WWV is

achieved through a special adjustment. Once this adjustment has been made the unit will have approximately the same accuracy as a primary frequency standard.

This model is manufactured by *The Hammarlund Mfg. Co., Inc.*, 460 W. 34th St., New York, 1, N. Y.

HEXACON SOLDERING IRON

Hexacon Electric Company has announced their new soldering iron which is wound for 300 watts and has a ⅜" diameter tip. By using the ⅜" tip instead of the usual ⅞" tip, the expense of tip replacement is reduced since any *Hexacon* tip of this diameter fits the iron.

The heating element is protected from mechanical injury by its housing in a damage-proof, hexagon-shaped barrel. Its hexagon shape also makes it possible for the iron to be held in a vice during tip replacement without danger of denting the housing or damaging element.

Equipped with 6 foot, 10,000 cycle, approved heater cord, the iron is also furnished with a stand. Terminals are

TELEVISION-

Does it Hold A Future For You?

SPECIAL INVITATION TO WAR VETERANS

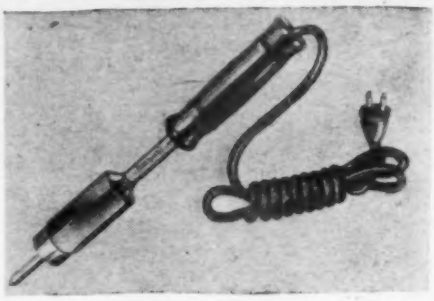
With extensive new training facilities under the personal supervision of the famed inventor of the radio vacuum tube, Dr. Lee de Forest, we are able to accept additional applications from Veterans for Television training under the G.I. Bill of Rights. For qualified men who are seriously considering entering a residence school, we have a limited number of Home Study Courses which are available free of charge. Your success with this course will not only help you to decide your own future in Television but will also aid us greatly in qualifying you for residence training.

Send your name and address for your Eligibility Questionnaire. If you qualify under the simple rules, you may start your Home Study Television Course at once and entirely without cost or obligation to you.

American Television Laboratories, Inc.

5050 BROADWAY · CHICAGO 40, ILLINOIS

easily accessible and constructed to relieve cord strain. The unit will operate on either d.c. or a.c., any frequency.



For further information write to *Hexacon Electric Company,* 179 W. Clay Ave., Roselle Park, New Jersey.

TEST LEADS

The *JFD Manufacturing Co.* has recently announced a new line of test leads and test lead accessories which will be of special interest to servicemen and amateurs.

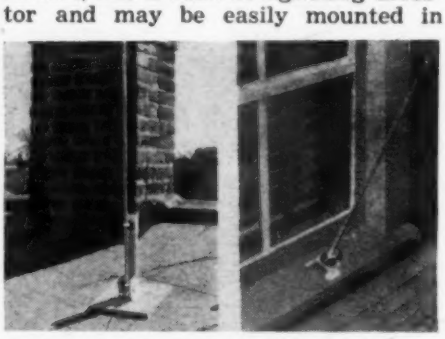
This line includes fifteen types of test leads made with fiber and cast phenolic prod handles. Insulated with kink-free flexible rubber, they are made of soft-drawn copper. End fittings include the phone tip, phono needle point, spade lugs, alligator clip, banana plug and elbow angle tips, all made of chromium-plated brass.

Descriptive literature and price lists will be sent upon request to *JFD Manufacturing Co.,* 4117 Fort Hamilton Parkway, Brooklyn 19, New York.

HOUSE AND WINDOW MASTS

A new line of house and window radio masts has recently been announced by *The Ward Products Corporation* of Cleveland, Ohio.

The house mast, which extends to 12 feet, has a built-in lightning arrestor and may be easily mounted in



various roof positions including installation on the soil pipe. The mast may be collapsed to four feet for easy handling.

The *Ward* window mast may be installed on window frame or sill in three minutes. It extends to eight feet and may be collapsed to 40 inches.

Additional data on these masts will be supplied by *The Ward Products Corporation,* 1523 E. 45th St., Cleveland, Ohio, upon request.

SPOT FREQUENCY GENERATOR

Electronic Manufacturing Company has announced their new Spot Frequency Generator Model No. 200, featuring the new Flip-a-switch.

(*Continued on page* 140)

RHS TELEVISION—SCOPE—POWER EQUIP'T

OSCILLOSCOPE KIT

5CP1 Cathode ray tube	ea.	$6.95
Socket for 5CP1	ea.	1.98
Anode button for 5CP1	ea.	.35
Shield for 5CP1	ea.	1.98
2X2A Rectifier tube	ea.	1.25
Plate cap for 2X2A ceramic	ea.	.25
Socket for 2X2A ceramic	ea	.20
Xformer, 1600v at 4ma., 700v ct at 150ma., 6.3 at 8A. 115v 60 cyc	ea.	8.50
Condenser, oil .5-2000v	ea.	2.10

ORDER SEPARATE OR COMPLETE KIT ..... Special **$16.95**

OIL CONDENSERS: G.E., AEROVOX, CD., etc.

1 mfd. 600 v	$0.35	1 mfd. 2000v	$0.95
2 mfd 600v	.60	2 mfd. 2000v	2.10
4 mfd. 600v	.75	3 mfd. 2000v	2.95
8 mfd. 600v	1.10	4 mfd. 2000v	3.95
10 mfd. 600v	1.40	12 mfd. 3000v	6.95
1 mfd. 1000v	.90	.05 mfd. 3000v	1.95
2 mfd. 1000v	1.05	.25 mfd. 3000v	2.95
4 mfd. 1000v	1.10	1 mfd. 3000v	3.50
8 mfd. 1000v	2.00	1 mfd. 5000v	6.85
10 mfd. 1000v	2.40	2 mfd. 4000v	7.60
15 mfd. 1000v	2.60	.1 mfd. 7000v	3.95
20 mfd. 1000v	5.95	1 mfd. 9000v	14.95
24 mfd. 1500v	6.95		

MICA CONDENSERS, SANGAMO, etc.

.0015-25,000v	$9.95	.004-8,000v	$2.25
.0005-20,000v	9.95	.002-8,000v	2.25
.0005-8,000v	2.25	.006-6,000v	1.95
.00025-8,000v	2.25	.007-5,000v	1.75
.005-8,000v	2.25	.003-8,000v	2.25

HIGH CAPACITY CONDENSERS

4000 mfd.—18WVDC	$1.95
4000 mfd.—30WVDC	2.95
1000 mfd.—15WVDC	.90

PORTABLE TRANSMITTER & RECEIVER NAVY TBY

28-80mc (5 and 10 meter bands). Complete with phones, mike, 8 tubes, crystal and key. Slightly used, fine condition. Wonderful buy **$42.50**

Vibrator and storage battery power supply for above **$19.95**

MCW—CF1—OSCILLATOR UNIT

Utilizes one 12SL7 gt twin triode as a combination 200KC calibration oscillator and frequency tripler, one 12-SA7 tube as a converter and one 12 SL7 gt tube as a signal detector and MCW audio oscillator supplying a 1000 cycle audio note. The CF1 unit employs a multivibrator circuit to obtain a 50 KC fundamental and harmonica, incorporating a 200 KC crystal as the controlling standard and will yield from 50 KC to 18 megacycles. This unit can be adapted into an excellent frequency meter, range 50 KC to 18 megacycles by adding an external power supply. Shipped with tubes, schematic and crystal.

SPECIAL PRICE **$14.95**

POWER SUPPLY FOR MARK 1-11-111 BC-19 OR OTHER EQUIPMENT

12 Amp-12v D.C. from 110v A.C. Unnecessary to tear set apart. Leave set portable.

COMPLETE READY TO PLUG IN **$32.50**

METERS—G.E., WESTON 3½"

0-5 Ma. D.C.	0-8 Amps. R.F.
0-50 Ma. D.C.	0-15 Amps. R.F.
0-100 Ma. D.C.	0-1.5 K.V. w/shunt
0-300 Ma. D.C.	0-3.5 K.V. w/shunt
0-500 Ma. D.C.	0-350 V. D.C.
0-8 V. A.C.	0-15 V. A.C.

Your choice any 3½" METER $3.95

2½" METERS

0-130 V. A.C.	0-1 Ma. D.C.
0-20 V. D.C.	0-8 Amp. D.C.

Your choice any 2½" METER $2.95

TUBES (Brand New) ARMY-NAVY INSPECTED

1E7G	$1.25	836	$2.95
2AP1	4.95	837	3.75
2C40	3.95	829A	3.99
2D21	1.50	838	3.95
2V3G	1.75	841	1.75
211	6.95	861	89.95
3AP1	5.95	866	.99
3BP1	6.95	872A	2.75
311	6.95	814	7.95
5BP1	6.95	884	1.50
5BP4	6.95	885	1.50
6AB7	1.25	8003	9.95
6AC7	.95	8005	4.95
6AG5	1.10	8016	1.95
6AG7	1.25	8025A	4.95
6AJ5	1.98	9JP1	14.95
6AK5	1.60	954	.99
6AL5	.99	955	.99
6AR6	1.29	956	.99
6AS6	1.29	957	.99
6AS7	1.29	9001	1.19
6C4	.75	9002	.99
6C5	.90	9003	.99
6F6	.99	9004	.99
6J4	2.25	9005	1.10
6J5	.90	9006	1.15
6J6	.99	15E	4.95
6L6	1.59	1619	.99
6Q4	1.25	1625	.89
6SL7	.99	1626	.89
6SN7	.99	250TH	14.95
6V6	1.19	2050	1.50
6SH7	.89	2051	1.50
7A4	1.45	257B/8001	14.95
801	2.30	28D7	1.95
802	1.15	30	.89
803	9.95	35T	3.50
804	8.95	304TH	16.95
805	5.50	726A/C	7.50
807	1.05	100TH	7.95
809	2.25	1N21	.49
810	3.55	1N23	.49
811	2.95	2C26A	.99
813	7.95	3E29	3.75
815	3.95	CK1006	1.98
VR90/30	.99	HF200	14.95
VR105/30	.99	HK24G	1.49
VR150/30	.99	VT127A	3.00

3½ KILOWATT TUBE (New)

JAN-128A (Federal). SPECIAL **$75.00**

NATIONAL DRIVE UNIT ONLY

PW-O or NPW-O **$2.95**

RELAY

Sigma No. 4RJ 2000 ohms SPDT. Can adjust to less than 1ma **$1.98**

PHOTOFLASH KIT

Build your own—Save $100.00 to $200.00!

Improved version of unit described in December, 1946 Radio News can be synchronized to camera. Contains complete diagram, all parts, Xformers, tubes, capacitors, resistors, etc., including the amglo 51Q4X repeating flash tube.

(Complete Parts Kit) **$49.95**

SELENIUM RECTIFIERS

Full Wave Bridge Types

INPUT		OUTPUT			
up to	18v A.C.	up to	12v D.C.	1 amp..	$ 1.95
up to	18v A.C.	up to	12v D.C.	5 amp..	4.95
up to	18v A.C.	up to	12v D.C.	10 amp..	7.95
up to	18v A.C.	up to	12v D.C.	15 amp..	10.95
up to	18v A.C.	up to	12v D.C.	30 amp..	16.95
up to	36v A.C.	up to	28v D.C.	1 amp..	3.95
up to	36v A.C.	up to	28v D.C.	5 amp..	7.95
up to	36v A.C.	up to	28v D.C.	10 amp..	13.95
up to	36v A.C.	up to	28v D.C.	15 amp..	19.95
up to	115v A.C.	up to	100v D.C.	.25 amp..	2.95
up to	115v A.C.	up to	100v D.C.	.6 amp..	6.95
up to	115v A.C.	up to	100v D.C.	5 amp..	19.95

TRANSFORMERS—115v ac 60 cyc

Hi-Voltage Insulation

6500v at 4 ma	$ 9.95
6000v at 2 ma	7.95
3950v at 4 ma. tap at 1250v-1 ma	7.50
3710v at 10 ma.; 2.5v at 3A; 2.5v at 3A	9.95
2500v at 10 ma	6.50
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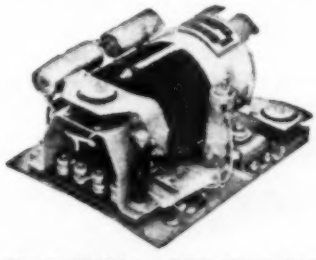

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A SIMPLE, low cost FM and television receiving antenna which is superior in performance and easier to install than many of the more elaborate and expensive types can now be constructed using the new 300 ohm lead-in wire K-1046, manufactured by *Federal Telephone and Radio Corporation*. Requiring only between 5 and 10 feet (depending on the frequency) of this inexpensive, highly flexible twin conductor transmission line, this antenna is very efficient and provides a perfectly matched folded dipole and lead-in for FM and television.

As indicated on Fig. 1 this antenna, a "T" match type, consists of a 300 ohm cable which is a half wavelength long, is shorted at both ends and has a one conductor cut in the center as the input or lead-in point. The entire construction takes between fifteen and twenty minutes and requires only three stripping and soldering operations.

First the cable is shorted at both ends by stripping the insulation for a short distance and twisting the two conductors together. Then they are soldered and an insulating lacquer spread over them to weatherproof the connection. These shorted ends also provide a means of supporting the antenna without affecting the characteristics of the transmission line.

Then the lead-in is connected to the midpoint of one conductor. This operation requires a little more caution since the width of the cut must exactly equal the conductor spacing of the lead-in. The cut is made just clear of the inside of one conductor exactly at the midpoint. Sufficient insulation is removed from the two ends of the conductors thus provided so as to enable the lead-in to be connected to them. The connections are soldered and lacquered and the assembly is now ready for mounting.

The antenna is mounted by simply suspending it on an insulating material, such as wood, using the two exposed short circuited ends as means of support. For maximum signal pick-up the antenna should be as high off the ground as possible. However when an outdoor antenna is either impracti-

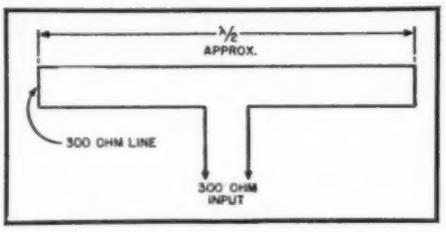


Fig. 1. Electrical representation of the FM and television folded dipole antenna.

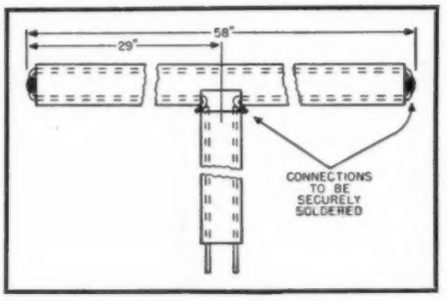
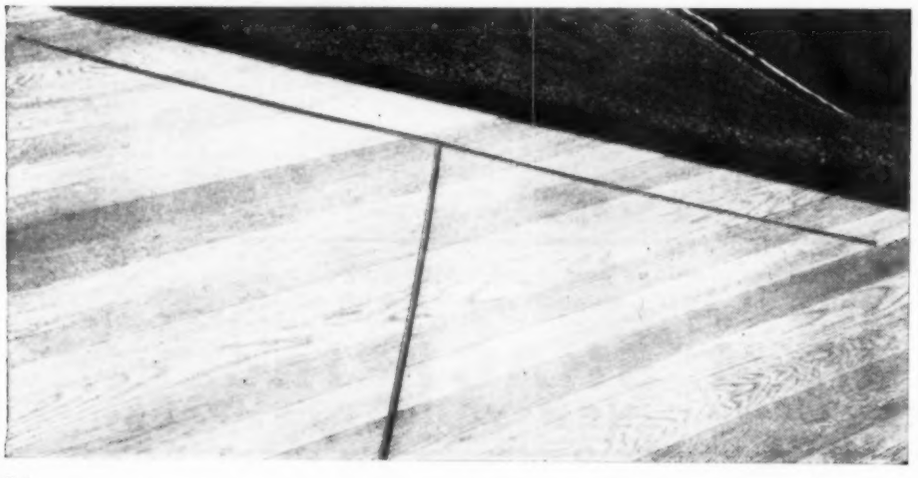


Fig. 2. Mechanical details show how the 300-ohm transmission line may be used.

This simple, low-cost 300-ohm line receiving antenna can be conveniently placed under the rug.



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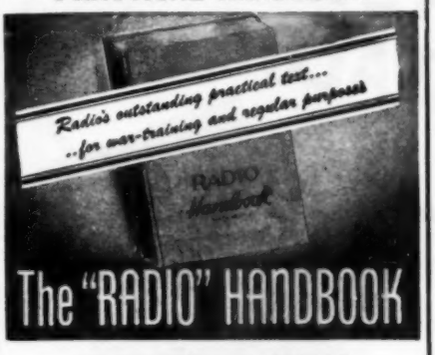

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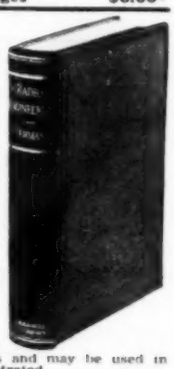

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cal (due to climatic conditions), or unnecessary, the antenna—due to the flat ribbon construction of the 300 ohm line—can conveniently be placed under the rug or behind a piece of furniture.

The antenna shown in Fig. 2 was designed for FM reception and is therefore 58 inches long. Since, as any folded dipole, it has an impedance of 300 ohms when removed from ground, and since the conventional input impedance of a FM or television set is 300 ohms, it provides a perfectly matched system.

The K-1046 is polyethylene insulated which makes it low loss, weather resisting, and extremely flexible even in sub-zero climate. This cable retains an attractive appearance since polyethylene is water repellent and therefore dries quickly and remains clean.

—30—

H.F. Local Oscillators

(*Continued from page* 55)

tube is about 20 mw. Incidentally, the shell of this tube runs hot at about 300 v.

A typical circuit using a small triode tube is illustrated in Fig. 2D. This tube is the *RCA* 955 and the circuit is a modified Hartley operating at around 200 mc. The output of the oscillator is inductively coupled to the mixer by means of the link coupling (A) in order to avoid loading down either the oscillator or the mixer.

Use of a *Shepherd Peirce* tube in a circuit is illustrated in Fig. 2E. The entire oscillator is in the tube and its resonator. The output of the resonator cavity is conducted to the crystal mixer by means of a coaxial cable and probe. Tuning this local oscillator is accomplished roughly by the cantilever screw described before and finely by means of the repeller voltage. One tunes merely for maximum output from the receiver. However, varying the cantilever screw through its entire range several maxima will be observed. Of course, the best maximum is selected for operation —30—

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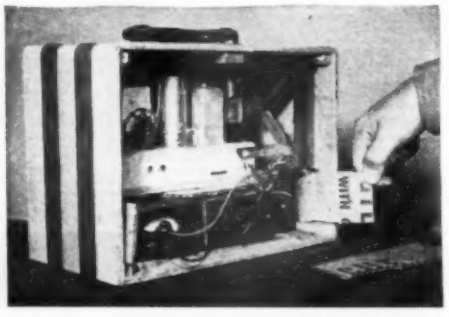

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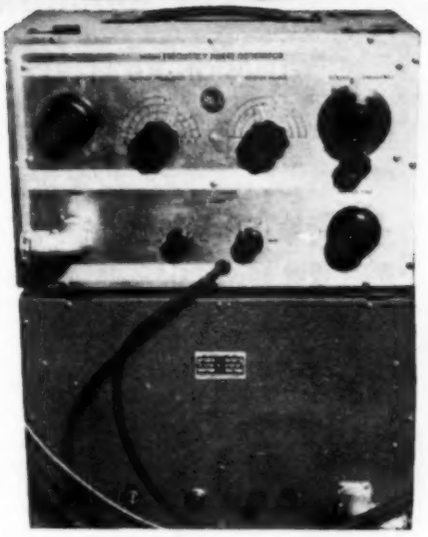

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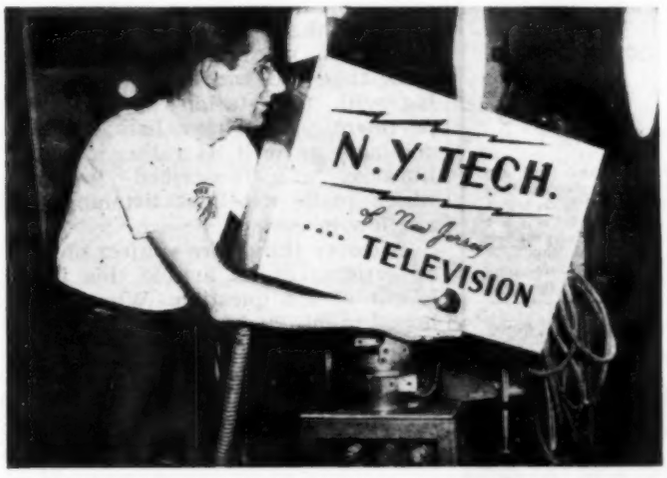

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(*Continued from page 60*)

tion does not charge for these extra services. Naturally, you pay for the time and for the program you select. But the advice and counsel of the people at the station are yours for the asking—a plus service like that you so often give to your own customers.

Costs for time vary depending on the size of the radio station (its coverage), the size of the market and the standing of the station in that market. Rates for an hour run from $25.00 to more than a thousand. Announcements sell for as little as $2.00 to nearly $200. Daytime rates are usually half the night time rates.

As to program costs, they depend entirely on the type of program. One person playing the piano and singing will cost much less than a five or ten piece instrumental or vocal group. You will find on many stations regular daily features which include a personality as master of ceremonies introducing recorded numbers by popular bands and orchestras. Such programs have very loyal and sizeable audiences and are not costly.

Then there are the women's programs—either the Home Forum type or the general type. They are excellent vehicles to reach women in their homes and their suggestions and recommendations command great respect.

Such programs as those mentioned above have this advantage; the personalities who conduct them are well known and well liked in their communities and the information they offer is accepted with confidence.

In the evening there are news programs and sports programs. Late at night there are programs of music. These are all possibilities for you and are well tested and proved.

One minute announcements and station breaks (the announcements between regular programs) are very successful mediums. They can be scheduled throughout the day and give you an opportunity to tell your story several times a day at low cost.

All of these are available to you. Or if you want to build your own show that, too, can be done by working with the station's program department. They have lists of talent and acts as well as rather complete libraries of transcribed programs which make excellent listening—and are low in cost.

To cover the entire subject of radio advertising in an article this length is out of the question. What I have hoped to do—and tried to do—is pique your interest so that you will want to find out more about it. More than that I have wanted to leave with you the idea that radio is a dynamic sales force, a powerful vehicle for selling products, ideas and services, one which you cannot afford to overlook in your planning for the years ahead.

—30—

Parts Lists

(FOR CIRCUIT DIAGRAMS APPEARING ON PAGES 78 AND 79)

AIR KING MODEL 4604D

Part No.	Code and Description
	R_1—1000 ohm, ½ w. res.
	R_2, R_3—6800 ohm, 2 w. res.
	R_4—2.2 megohm, ½ w. res.
	R_5—47,000 ohm, ½ w. res.
2470-A	R_6—.5 megohm vol. control
	R_7—10 megohm, ½ w. res.
	R_8—220,000 ohm, ½ w. res.
2521	R_9—.25 megohm tone control & sw.
	R_{10}—470,000 ohm, ½ w. res.
	R_{11}—300 ohm, w.w., 2 w. res.
	R_{12}—1500 ohm, w.w., 2 w. res.
	R_{13}—400 ohm, w.w., 2 w. res.
	R_{14}—22,000 ohm, ½ w. res.
	R_{15}—150 ohm, w.w., ½ w. res.
	R_{16}—100,000 ohm, ½ w. res.
A1725	C_1—3-30 μμfd., 3 sec. trimmer cond.
	C_2—.05 μfd., 600 v. cond.
	C_3—.1 μfd., 400 v. cond.
	C_{4A}, C_{4B}—Part of T_1
	C_{5A}, C_{5B}—Part of T_2
	C_6, C_7, C_{25}—100 μμfd. mica cond.
	C_8—.002 μfd., 400 v. cond.
	C_9—250 μμfd. mica cond.
	C_{10}—.005 μfd., 400 v. cond.
	C_{11}—.01 μfd., 600 v. cond.
	C_{12}—.01 μfd., 800 v. cond.
20105	C_{13}—25 μfd., 25 v. elec. cond.
A20102	C_{14}—20/16/16 μfd., 350/350/350 v. elec. cond.
	C_{15}—.02 μfd., 400 v. cond.
1975	C_{16}, C_{17}—.02 μfd., 600 v. oil-filled cond.
	C_{18}—47 μμfd. mica cond.
1668	C_{20}—Variable cond.
	C_{22}—5020 μμfd. mica cond.
	C_{24}—82 μμfd. mica cond.
28170	L_1—Loop coil
28167	L_2—S.w. antenna coil
28169	L_3—B.c. osc. coil
28168	L_4—S.w. osc. coil.
28175	L_5—Wave-trap coil
3360	T_1—I.f. input trans.
3530	T_2—I.f. output trans.
1333	T_3—Output trans.
1020	T_4—Power trans.

RADIOLA MODELS 61-6, 61-7

Part No.	Code and Description
30685	R_{1A}—33,000 ohm, ¼ w. res.
30649	R_1—2.2 megohm, ¼ w. res.
12928	R_2—3.3 megohm, ¼ w. res.
30787	R_3—47,000 ohm, ¼ w. res.
38406	R_4, S_2—Vol. control & sw.
30992	R_6—10 megohm, ¼ w. res.
30880	R_7—150 ohm, ½ w. res.
30648	R_8—470,000 ohm, ¼ w. res.
30152	R_9—1000 ohm, 1 w. res.
14583	R_{10}—220,000 ohm, ¼ w. res.
37962	R_{20}, L_2, L_5—Antenna loop coupling coil
39636	C_{1A}, C_{17}—220 μμfd. mica cond.
70627	C_1, C_{18}, C_{15}—.005 μfd., 600 v. cond.
70366	C_2, C_3, C_5, C_6—Variable tuning cond.
39622	C_4—56 μμfd. mica cond.
71392	C_{8B}—450 μμfd. mica cond.
70367	C_7—2-10 μμfd. mica cond.
70361	C_8, C_9, L_3, L_4—First i.f. trans.
70612	C_{10}, C_{20}—.025 μfd., 400 v. cond.
70617	C_{11}—.1 μfd., 400 v. cond.
70362	C_{12}, C_{13}, C_{14}, C_{16}, L_{10}, L_{11}—Second i.f. trans.
70615	C_{25}—.05 μfd., 400 v. cond.
39152	C_{30}, C_{30A}—50/30 μfd., 150/150 v. elec. cond.
70367	C_{27}—1.6-18 μμfd. adjustable cond.
71396	L_1, L_6—Antenna coil
71397	L_4—Antenna loop
70359	L_8, L_7—Osc. coil
71384	S_1—Range sw.
71398	T_1—Output trans.

WESTINGHOUSE MODELS H-104, H-105, H-107, H-108

Part No.	Code and Description
V-3222	R_1—2 megohm vol. control
V-3221	R_2, SW_1—2 megohm (tapped at 400,000 ohms) vol. control & sw.
RC10AE224M	R_3—220,000 ohm, ¼ w. res.
RC10AE105M	R_4, R_5—1 megohm, ¼ w. res.
RC41AE682K	R_6—6800 ohm, 2 w. res.
RC10AE223M	R_7, R_8—22,000 ohm, ¼ w. res.
RC10AE474M	R_9, R_{10}—470,000 ohm, ¼ w. res.
RC10AE681M	R_{11}—680 ohm, ¼ w. res.
RC10AE104M	R_{12}—100,000 ohm, ¼ w. res.
RC10AE473M	R_{13}—47,000 ohm, ¼ w. res.
RC10AE684M	R_{14}—.68 megohm, ¼ w. res.
RC10AE330K	R_{15}, R_{16}—33 ohm, ¼ w. res.
RC41AE472M	R_{17}—4700 ohm, 2 w. res.
RC41AE153M	R_{18}—15,000 ohm, 2 w. res.
V-3282	R_{19}—120 ohm, 3 w. res.
RC10AE225M	R_{20}—2.2 megohm, ¼ w. res.
RC10AE101M	R_{21}, R_{28}—100 ohm, ¼ w. res.
RC41AE103M	R_{23}—10,000 ohm, 2 w. res.
RC10AE103M	R_{24}—10,000 ohm, ¼ w. res.
V-3249	R_{25}, C_{37}, C_{38}, C_{39}, C_{40}, L_{10}, L_{13}—Second i.f. trans.
V-3245	R_{26}, C_{41}, L_{12}, L_{13}—Untuned r.f. trans.
RCM20A330M	C_1—33 μμfd. mica cond.
RCP10W4103A	C_2, C_3, C_4—.01 μfd., 400 v. cond.
RCM20A151M	C_5, C_6—150 μμfd. mica cond.
RCP10W4203	C_7—.02 μfd., 400 v. cond.
RCM20B470M	C_8—47 μμfd. mica cond.
RCP10W4104A	C_9—.1 μfd., 400 v. cond.
V-3170	C_{10}—S.w. ant. trimmer
V-3216	C_{11}, C_{12}, C_{13}, C_{14}—40/40/20/5 μfd., 350/350/25/250 v. elec. cond.
V-3241	C_{15}, C_{16}—Dual line filter cond.
RCM20A680M	C_{17}—68 μμfd. mica cond.
RCM30C282H	C_{18}—.0028 μfd., s.w. padder cond.
V-3233	C_{19}, C_{20}—2-gang var. cond.
V-3217	C_{21}, C_{22}, C_{23}—3-gang trimmer cond.
V-3236	C_{24}—20 μfd., 25 v. elec. cond.
RCP10W4503A	C_{25}—.05 μfd., 400 v. cond.
RCP10W4303A	C_{26}—.03 μfd., 400 v. cond.
RCP10M4503A	C_{27}—.05 μfd., 400 v. cond.
RCP10M6502A	C_{28}, C_{29}—.005 μfd., 600 v. cond.
V-3191	C_{30}—Broadcast ant. trimmer
RCP10W6202A	C_{31}—.002 μfd., 600 v. cond.
RCM30B222M	C_{32}—.0022 μfd. mica cond.
RCM20C181J	C_{33}—180 μμfd. mica cond.
RCP10W6202M	C_{34}—.002 μfd., 600 v. cond.
V-3218	C_{35}, C_{36}, L_8, L_9—First i.f. trans.
V-3317	C_{42}, C_{43}, C_{44}, C_{45}, C_{46}, C_{47}, L_{14}, L_{15}, L_{16}, L_{17}, L_{18}, L_{19}—Push button tuner
V-3224	L_1, L_2—S.w. ant. coil
V-3238	L_3—Ant. loading coil
V-3243	L_4, L_5—Broadcast and s.w. osc. coil
V-3313	L_6—Cathode osc. coil
V-3394 or V-3283-1	L_7—Loop assembly
V-3289	SW_2, SW_3, SW_4—Selector sw.
V-3261-1	SW_{5A}, SW_{5B}—Push button sw.

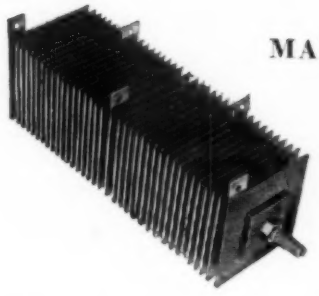
STROMBERG-CARLSON MODELS 1020, 1120, SERIES 10

Part No.	Code and Description
26333	R_1, R_{10}—1000 ohm res.
26373	R_2, R_{12}—2.2 megohm res.
26331	R_3—680 ohm res.
26349	R_4—22,000 ohm res.
30417	R_5, R_6—10,000 ohm res.
26353	R_7, R_9, R_{11}—47,000 ohm res.
26351	R_8—33,000 ohm res.
29560	R_{13}—1 megohm vol. control
26375	R_{14}—3.3 megohm res.
26335	R_{15}—1500 ohm. res.
26365	R_{16}, R_{17}, R_{18}, R_{19}, R_{28}—470,000 ohm res.
26345	R_{20}—10,000 ohm res.
26335	R_{21}—68,000 ohm res.
26346	R_{22}—12,000 ohm res.
25347	R_{23}—15,000 ohm res.
33913	R_{24}—240 ohm res.
26329	R_{26}—470 ohm res.
149003	R_{29}, R_{30}—60,000 ohm res.
33885	C_1, C_2, C_3—Aligning cond.
33755	C_4, C_5—Var. cond. & pulley
33909	C_6—200 μμfd. cond.
24559	C_7, C_8, C_{19}, C_{20}, C_{25}, C_{26}, C_{30}—100 μμfd. cond.
25150	C_9—.02 μfd. cond.
27305	C_{10}—50 μμfd. cond.
33907	C_{11}—147 μμfd. cond.
33904	C_{12}—410 μμfd. cond.
27081	C_{13}—Aligning cond.
32056	C_{13A}—25 μμfd. cond.
33567	C_{14}—Aligning cond.
33880	C_{15}, C_{16}, L_9, L_{10}—First i.f. trans.
33882	C_{17}, C_{18}, L_{11}, L_{12}—Second i.f. trans.
24405	C_{21}—.04 μfd. cond.
29891	C_{22}, C_{23A}—.05 μfd. cond.
27760	C_{23}, C_{29}—.005 μfd. cond.
27782	C_{24}—.03 μfd. cond.
25485	C_{27}—.01 μfd. cond.
31480	C_{28}, C_{28A}—.01 μfd. cond.
25481	C_{31}—.002 μfd. cond.
33894	C_{32}, C_{33}, C_{34}, C_{35}—20/15/15/40 μfd. elec. cond.
33906	RC_1—Compensator
33910	L_1—Antenna coupling loop
37114	L_2—Loop (Model 1020PL)
33845	L_2—Loop (Model 1120P)
33876	L_3—"A" band ant. coil
33878	L_4—S.w. ant. coil

Important Message to Radio News Readers:

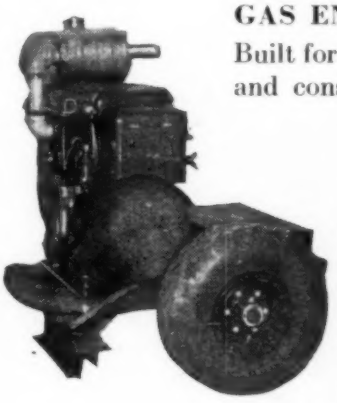
There is no mystery about the excellent equipment shown on this page. The quality is guaranteed by the Stamp of Government approval. To radio men the usefulness of each piece of equipment is obvious. And the prices reflect true values. Moreover, Wells backs every item with a substantial guarantee.

These and thousands of other radio-electric components are carried in our huge stock available for immediate delivery. Special catalogs of each type of equipment will be mailed upon request.



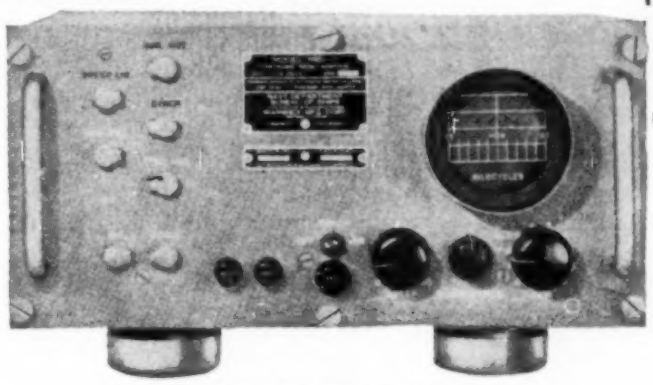
MALLORY STANDARD RECTIFIERS

Type 36B7 single phase, full wave, bridge circuit rectifier. Magnesium-copper sulphide type noted for long life at high current output. Recommended for battery chargers, battery substitutes, or wherever a source of low voltage D. C. is required. Special price—**$4.85** each.



115 VOLT 60 CYCLE A.C. GAS ENGINE GENERATOR

Built for Army field duty by Onan and conservatively rated at 350 watts. Smooth, quiet running gas engine will self-start if used with a 12 volt storage battery. Battery recharges automatically. Carrying cart fitted with aircraft wheels and tires for easy portability. Shipped complete with carrying cart, battery table, tools and instruction book—only **$149.50.**

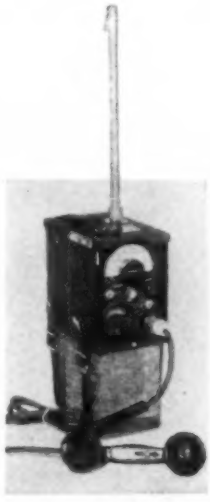


PANORAMIC ADAPTOR

This is the Navy version of the now-famous aid to improved station operation. This unit was built for continuous use and is consequently more rugged than commercial types. Operates on 115 volts, 60 cycles. Available in two models: RBU (50 KC sweep) and RBV (100 KC sweep). Either model only **$94.50** each.

WALKIE TALKIES

Complete portable Army units ready to operate. Phone transmitter and receiver tunable over a continuous band from 28 to 52 mc. Crystal calibrator. Complete with tubes, battery, handset, crystal and telescopic antenna. Renewed and tested by the Government—only **$45.00** each. Extra batteries (80 hours)—**$4.75** each. Adaptor for use with commercial type batteries—**$2.50** each.



All prices F.O.B. Chicago

The following lists or catalogues now ready: Amateur Catalog H200A, relays, volume controls, resistors, oil condensers, mica condensers, micro-switches, transmitting tubes, phone jacks and plugs, Jones strips.

WELLS SALES, INC.

Watch for the Wells Display at Your Jobbers

4717 W. MADISON ST., DEPT. R-4, CHICAGO 44, ILL.

33886	L_6—R.f. choke assembly
33877	L_9—"A" band osc. coil
33879	L_7—S.w. osc. coil
33908	L_8—Wave trap
33853	L_{14}, L_{15}—Output trans.
33900	L_{10}, L_{17}, L_{18}, L_{19}—Power trans.

SPARTON MODELS 526, 526X, 526PS

Part No.	Code and Description
BR-12G-203	R_1—20,000 ohm, ½ w. res.
BR-12N-105	R_2—1 megohm, ½ w. res.
BR-12S-101	R_3—100 ohm, ½ w. res.
BR-12S-105	R_4—1 megohm, ½ w. res.
BR-12S-563	R_5—56,000 ohm, ½ w. res.
PA-4400-3	R_6—.5 megohm vol. control & sw.
BR-12S-271	R_7—270 ohm, ½ w. res.
CR-12S-273	R_8—27,000 ohm, 1 w. res.
DR-12S-103	R_9—10,000 ohm, 2 w. res.
BR-12S-274	R_{10}—270,000 ohm, ½ w. res.
BR-12N-684	R_{11}—680,000 ohm, ½ w. res.
BR-12S-681	R_{12}—680 ohm, ½ w. res.
PB-40402	C_{1A}, C_{1B}—Variable cond. C_{2A}—R.f. trimmer C_{2B}—Osc. trimmer
PC-40GK-503	C_4—.05 µfd., 200 v. cond.
PC-40GL-104	C_5—.1 µfd., 400 v. cond.
AB-43500-44	C_{6A}, C_{6B}—First i.f. trimmer
PC-40GK-104	C_7—.1 µfd., 200 v. cond.
AB-43500-55	C_{8A}, C_{8B}—Second i.f. trimmer
MC-60G-101	C_9, C_{10}, C_{12}—100 µµfd., 500 v. cond.
PC-40GK-203	C_{11}—.02 µfd., 200 v. cond.
PC-40GL-503	C_{13}—.05 µfd., 400 v. cond.
PC-40GM-103	C_{14}—.01 µfd., 600 v. cond.
PA-4300-3	C_{15}—20/10/10 µfd., 450/450/450 v. elec. cond.
PC-40GL-503	C_{16}—.05 µfd., 400 v. cond.
PC-40GK-202	C_{17}—.002 µfd., 200 v. cond.
PA-4328-1	C_{18}—15 µµfd. cond.

TRUETONE MODEL D2624

Part No.	Code and Description
B84393	R_1—39,000 ohm, ½ w. res.
B84472	R_2—4700 ohm, ½ w. res.
B85473	R_3, R_5—47,000 ohm, ½ w. res.
B84332	R_4—3300 ohm, ½ w. res.
B85104	R_6—100,000 ohm, ½ w. res.
B85225	R_7—2.2 megohm, ½ w. res.
B85475	R_8—4.7 megohm, ½ w. res.
36X309	R_9—.5 megohm vol. control & sw.
B84153	R_{10}—15,000 ohm, ½ w. res.
B85474	R_{11}—470,000 ohm, ½ w. res.
B84333	R_{12}—33,000 ohm, ½ w. res.
B84823	R_{13}—82,000 ohm, ½ w. res.
B85474	R_{14}—470,000 ohm, ½ w. res.
B84181	R_{15}—180 ohm, ½ w. res.
B85224	R_{16}—220,000 ohm, ½ w. res.
43X214	R_{17}—775 ohm, 28 w. res.
B84270	R_{18}—27 ohm, ½ w. res.
C85152	R_{19}—1500 ohm, 1 w. res.
B66102	C_1—.001 µfd., 200 v. cond.
17A152	C_2, C_3—2-23 µµfd. ant. & osc. trimmers
14A148	C_{3A}, C_{3B}—Gang cond. & pulley
46X289	C_4—475 µµfd., 180 v. cond.
17A174	C_5, C_6—Part of C_3
47X463	C_7—47 µµfd. cond.
47X466	C_8—68 µµfd. cond.
17A234	C_{10}—230-525 µµfd., 600 kc. padder cond.
B66403	C_{11}, C_{23}—.1 µfd., 200 v. cond.
B66403	C_{12}, C_{15}, C_{22}—.04 µfd., 200 v. cond.
	C_{13}, C_{14}—Part of T_5
47X446	C_{16}, C_{21}—47 µµfd. cond. C_{17}, C_{18}—Part of T_3
47X476	C_{19}—100 µµfd. cond.
B66502	C_{20}—.005 µfd., 200 v. cond.
47X467	C_{24}—470 µµfd. cond.
B66103	C_{25}, C_{26}—.01 µfd., 200 v. cond.
B64253	C_{28}—.025 µfd., 200 v. cond.
45X342	C_{27A}, C_{27B}, C_{27C}—50/50/20 µfd., 150/150/25 v. elec. cond.
D66204	C_{29}—.20 µfd., 400 v. cond.
D66104	C_{30}—.10 µfd., 400 v. cond.
9A1443	T_1—"D" range ant. coil assembly
9A1818	T_2—"B" band loop antenna
9A1444	T_3—"D" range osc. coil assembly
9A1442	T_4—"B" band osc. coil assembly
9A1793	T_5—First i.f. coil assembly
9A1794	T_6—Second i.f. coil assembly
51X118	T_7—Output trans.

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PROJECTION TELEVISION LENSES

AMERICAN Optical Company's workers are currently engaged in the manufacture of a complex optical system for 1947 model projection television receivers.

This system, comprising a spherical mirror and correcting lens, takes the television images from the receiver's cathode-ray tube and enlarges them by means of the mirror. The images are then reflected through the correcting lens to a flat mirror which in turn reflects the focused picture onto the viewing screen. The large picture below shows the television workers engaged in polishing spherical mirrors to the highly precise specifications needed for accurate, clearly defined television reception.

The worker shown in the inset is inspecting one of the image-correcting lenses used to eliminate aberrations introduced into television images by the enlarging, reflecting mirror. This image-correcting power of the lens is produced by complex wave-like curves introduced into the lens by a special process. —30—

WAR SURPLUS EQUIPMENT...

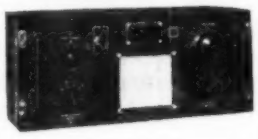
At A Fraction of Their Original Government Cost!

SUN RADIO OF WASH., D. C.

PORTABLE 2 BAND RECEIVER

Built to rigid specifications of armed forces. 5 tube superhet covering std. bdcst. and 5.8-18.3 mc shortwave. High sensitivity proven by war use overseas. Complete with longlife 91½v pack and instruction-maintenance manual. Brand new in sealed cartons..... $29.95

Above set also available with built-in whip antennae for added sensitivity..... $34.95

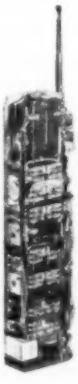


R. F. TUNING UNITS

Beautiful black crackled aluminum cabinet with 2 variable transmitting condensers and 2 vernier dials, 1 heavy duty ceramic 4 position wafer switch, mica condensers, 2,500 working volts and coils wound on porcelain ribbed forms. Available TU5B (1500-3000kc), TU6B (3000-4500kc), TU7S (4500-6200), TU8B (6200-7700kc) and TU10B (10000-12500kc). Please specify model..... $3.89

HANDIE TALKIE CHASSIS

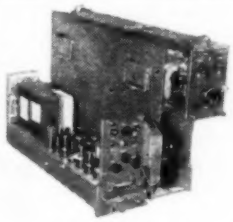
An ideal unit for building up receiver ortransceiver. Comes completely wired with 1—1R5, 1—1T4, 1—1S5, 2—3S4 tubes and two 455kc iron core I.F. transformers and antennae less receiving and output coil also crystals.



$9.95

G. I. PORTABLE WINDUP PHONOGRAPH

A high quality, sturdily built, full toned windup phono originally built for armed forces as morale phono. Special triple spring motor plays 3 records on 1 winding. Speed adjustable from 33-78 revs. Brand new packed with 100 multiple play needles..... $19.95



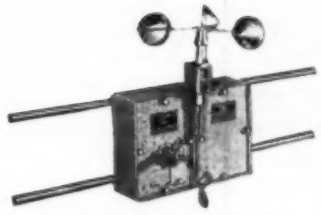
WAVEMETER

A precision wavemeter tuning from 150-210 mc containing a high quality resonant cavity wavemeter, oscillator, heterodyne amplifier, electric tuning eye, complete with 19 tubes, 110v AC power supply. Original Gov't. cost $550..... $24.95

HEAD-PHONE

Signal Corps 4000 ohm magnetic headphone. This double headphone set comes complete with phono plug, cord and leather covered headphone band . . . Brand New..... $1.87

*Please enclose 30¢ to cover mailing and handling.



NAVY COMBINATION V.H.F TRANSMITTER AND ANEMOMETER

The transmitter and anemometer may be operated as 2 separate units or may be used together for electronic weather readings. Transmitter operates on battery (67½v B and 1½v A), frequency 80 to 105 mc, complete with 2—1G4 tubes. Anemometer is beautiful precision designed instrument enabling you to determine wind velocity in miles per hour, 6v operation. These instruments Brand New and packed complete with full instruction manual..... $19.95

6v Battery..$0.60

AIRCRAFT INTER-COM AMPLIFIER

Comes completely wired in aluminum cabinet with following: 2—12A6, 2—12J5 tubes, 1 bathtub condenser, 3 can filters, 12 precision resistors, 4 low loss octal sockets, shielded input and output transformers, 2 shielded R.F. chokes, 1 S.P.S.T. toggle, 28v D.C. dynamotor. Sun Radio furnishes the instructions for easy conversion to Hi-Fidelity phono or speech amplifier..... $8.95

PORTABLE AMPLIFYING MEGAPHONE

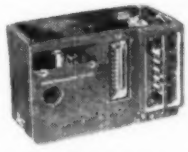
A complete voice amplifier operating off 67½B and 1½A battery supply. Used by army for firing range control. Press button and voice projected up to ¼ mile. Complete with portable carrying case, tripod for stationary mounting, strap for shoulder portability . . . excellent for sporting events, building, surveying, etc..... $59.95

NAVY SPEAKERS

Stromberg Carlson and RCA waterproof speakers. Brand New in original cartons.

(a) 4½-ft. re-entrance trumpet with 25 watt PM driver unit and line matching transformer. $125 value, for..... $32.50

(b) 25 Watt PM driver unit with line matching transformer and projector mounted in heavy duty round metal baffle. Ideal for communication receivers and sound systems at lowest price ever offered..... $14.95



BC-684 F.M. 35 WATT TRANSMITTER

Brand new, complete with 8 tubes, crystal control, 10 channel pushbutton, nonlenier modulation coil . . . less coverplate, crystal and power supply..... $21.95

DYNAMOTOR PE-103

Brand New dynamotor operating from 6 or 12v battery will deliver 500 v D.C. at 160 ma..... $13.95

HALLICRAFTER SP44 PANORAMIC ADAPTOR

A precision instrument by Hallicrafter to make your tuning and scanning exacting. Shipped to your home..... $99.50

RHOMBIC RECEIVING ANTENNAE

Complete with all accessories including 2200 feet of No. 14 copper weld wire, 50 feet of heavy twin X lead 72 ohm good up to 2 kw, dozens of insulators, pulleys, neon lightning arrestors, ground rods and everything to erect. Less poles..... $24.95

SUN RADIO

OF WASHINGTON, D. C.

938 F STREET, N. W. WASH. 4, D. C.

All items F.O.B., Washington, D. C. All orders $30.00 or less cash with order. Above $30.00, 25 percent with order, balance C.O.D. Foreign orders cash with all orders plus exchange rate.

Modulation Meter

(Continued from page 46)

the audio component may be measured.

The meter is built into a sloping panel case measuring 5 inches wide, 5½ inches high, and 4½ inches deep. This case was formed from scrap aluminum, as the available small sloping meter cases were too small.

The left hand control is a four-pole, three-position switch wired to read carrier, positive peaks, or negative peaks. The jack in the center permits a pair of headphones to be inserted for aural monitoring of the signal. The right hand knob controls the tuning condenser, C_2.

Parts are mounted where convenient in the case, with care being taken to have short leads in the r.f. portion of the circuit. A four-prong socket is used for the plug-in coils which may be used to cover various ranges. If the meter is to be used for modulation measurement only, it will be possible to dispense with this coil socket and its associated coils, as the link used to couple to the transmitter may be tuned by means of C_2. However, it is well to provide for changing coils to improve the versatility of the unit.

It is desirable in wiring, to bring out long leads for the terminals of resistor, R_2, as this resistor must be adjusted when the meter is calibrated, to allow the printed scale to be used.

It should be noted that transformer, T_1, is worked backwards from its normal connections. The normal secondary is used as the primary, and vice versa.

The meter used in this model, was a *Triplett* model 321, 0-1 ma. range, with an internal resistance of 33 ohms. The scale shown in Fig. 2 may be pasted directly over the present scale on the meter. It will also fit several other makes of meters of approximately the same size.

When construction has been completed, a coil for the appropriate range should be plugged into the socket, and the antenna terminals connected to a three- or four-turn link. This link should now be loosely coupled to the final tank of a phone transmitter, with no modulation applied to the transmitter. With the switch, S_1, in the r.f. position, the condenser, C_2, should be tuned to give an indication exactly to the *"Set Car."* point on the scale. It will probably be found necessary to attach a ground to the case of the instrument to eliminate body capacity.

An oscilloscope or accurately cali-

Coil specifications for the various bands covered by the field strength meter.

Band	L_1	L_2
80	6	35 t. #22 p.e. closewound
40	4	15 t. #20 p.e. closewound
20	3	7 t. #16 p.e. closewound
10	2	4 t. #16 p.e. 1" long

All windings on 1½" dia. forms. L_1 wound at cold end.

SPRAGUE TRADING POST

SWAP • BUY • SELL

FOR SALE—Dismantled 150-watt phone/cw transmitter, T-40 final; 807 buffer; 6L6 xtal osc. modulator ending with 4-46's push-pull parallel. Will sell all or part including power supplies. Morris M. Rosen, W3MEE, 1640 Moreland Ave., Baltimore 16, Md.

SWAP—Will trade Lewis 10" metal shaper complete with ½ h.p. motor, belts and pulleys, milling attachment, 8" 360° swivel vise, all steel construction, all tools, hi-speed end mills ready to run. Cost $250 used only 2 weeks, weighs 200 lbs. Want transmitting or other ham gear. D. T. Jones, 316 Kosciuszko St., Nanticoke, Pa.

WANTED—Communication type receiver, Sky Champion or what have you? Have I.C.S. radio course, drafting set, etc. to swap. J. Rosenberg, 1932 Daly Ave., New York 60, N. Y.

WANTED—Power supply, 110v A.C. input, 12v 12 amps. D.C. output. R. L. Bruce, 1171 Union St., Manchester, N. H.

SELL OR TRADE—New Hammarlund HQ-129Z receiver, $169; Superior PB-100 multimeter, $25; Solar CB-1-60 capacitor checker, $25; Clough-Brengle signal generator, $25, also radio books, tubes and parts. Want BC-610. K. H. Stello, W6VTC, 12026 Peoria St., Roscoe, Calif.

WANTED—One UTC S-35 filter choke, 20 Hy. 400 ma., and one UTC S-36 swinging choke, 5/25 Hy. 400 ma. Badly needed. Will pay cash or trade. All letters answered. Abel Gomes, 8 Duke St., Ludlow, Mass.

WANTED—Hallicrafters SX-28-A in excellent condition with matching speaker; also Hallicrafters HT-9 or Meissner 150-B transmitter. K9AAB, 7633 S. Union Ave., Chicago, Ill.

FOR SALE—Instructograph code outfit with built-in battery-operated oscillator. Bill Richardson, Box 371, Lawrenceburg, Tenn.

FOR SALE—UTC VT1 equalizer; Kenyon BLEQ line equalizer and Inca variable impedance 30-watt line to RF load modulation transformer. All perfect with complete instructions. $7 for the lot plus postage. Phil Ross, 280 Wadsworth Ave., New York 33, N. Y.

SWAP OR SELL—50' ¾" wide cable shielding, Reed frequency meter 58-62 cycles, 2 pairs of low voltage Selysns, 5" scope tube, used 800 tube, few new 6AC7 tubes and other items. Write for list. All inquiries answered. Hosea Decker, Delaware, Ohio.

FOR SALE—1 KW CW ¾ KW phone all band cabinet type transmitter; also low power CW rig and Sky Buddy Receiver. Want BC610, R44/ARR5, R45/ARR-7 or other receiver. Geo. J. Pasquale, 601 Bashford Lane, Alexandria, Va.

FOR SALE—NC-46 receiver with matching speaker, like new, $90. William P. Reid, 52 17th Ave., Columbus 1, Ohio.

SWAP OR SELL—RME45 receiver, used 75 hrs.; SX25, excellent shape; new Meissner signal splicer and uni-signal selector. VX101 Jr. band-switching E.C.O., etc. Want Rider manuals, test eqpt., parts, etc. All inquiries answered. Frest Radio, 811 21st St., East Moline, Ill.

FOR SALE—Brand new UTC HA-100 matching HA class B input, matching 20-watt class B to RF output and PA-46 choke. All for $12, plus postage. P. A. Rosenblatt, W2AKF, P.O. Box 905, Hoboken, N.J.

FOR SALE — 7-tube crystal controlled transceiver, 75 meters with crystals, no batteries, phones or mike. Instruction book included. Joseph Adler, Box 533, Milbank, So. Dak.

WANTED—Used Hallicrafter S20R. Must be in good condition and reasonable. All inquiries answered. P. Ross, 303 S. Capitol, Iowa City, Iowa.

WANTED—500 mil. filter choke by Stancor for BC-610. Will sell Thordarson swinging choke T19C37 and smoothing choke. T19C44, 400 ma., $13 pair. S. C. Macy, W4KTZ, Eupedon Farm, Clarksville, Tenn.

FOR SALE OR TRADE—Hallicrafter S-41 receiver and Sherman tank transmitter. Receiver converted to A-C operation, 55 watts output. L. Barenfeld, 1805 49th St., Brooklyn, N. Y.

WILL TRADE—One 48.008 mgc. xtal worth $20 for pair of 813's. Dr. J. E. Greenbaum, W1LIG, 1862 North Ave., Bridgeport 4, Conn.

FOR SALE—Radio shop in small town. Excellent territory. Shop size is 15' x 18'. Attractive and well built. J. P. Glassel, Cushing, Wisc.

OPPORTUNITY—Will consider starting with partner in radio shop in or close to Ravenna, Ohio, if you have building. I have small amount of capital, also stock and equipment now in storage. Includes 170 tubes, parts, work bench, desk, tools, 14 vol. Rider manuals, test eqpt. such as sig. gen., 571 Supreme, 585 Dynameter, RCP 802 tester, Sprague DeLuxe Telohmike, 30 watt P.A. system, etc. Or, will sell the works for cash. Write for complete list. W. S. Crooks, c/o Cartmill's, State Rt. 97, R.D. 2, Loudonville, Ohio.

FOR SALE—Vomax 900; 6v D.C. 115 A.C. converter; condenser bridge; tube tester; analyzers; CA-10 signal tracer; 25 car radio vol. controls; speakers; new and used tubes; late model multimeter; signal generator. Write for details. Triplett Radio, Box 56, Bixby, Okla.

FOR SALE—Late model No. 315 Radio City tube tester, takes them all, has roll chart. New condition, little used. All letters answered. D. Pettiford, Box 22, Lewis Center, Ohio.

FOR SALE—Microvolted signal generator, 6 bands, precision laboratory built, 110v A.C. Beat frequency generator companion to foregoing 0-16,000 cycles, built-in calibrator. $100 for both. Victor Sive, 284 Loomis St., Little Falls, N. Y.

WANTED—Model cch, Carron signal amplifier; 954 Precision set and tube tester; Rider manuals 1-14 unabridged; precision sig. gen. E200 and Solar Exameter CF-1-60. Cash. Have two Westinghouse Rectigon battery chargers A-1 shape, input 110v A.C. 60 cy., output 8v D.C. at 2 amps. also two Radio City Products tube and set testers 801M and 803. Boyd Branch, 1732 1st St. N.W., Washington 1, D.C.

FOR SALE—Complete radio shop test equipment. Plenty of new tubes, parts, etc. Write for list. Cash or will trade for amateur xmitter and receiver. N. A. Lester, 406 Avenue A, Palestine, Texas.

SELL OR TRADE—1928 to 1942 Philco yearbooks; 3" cathode ray tubes; many odd radio tubes; 6v 10" P.A. speakers; Weston 697 VOM, etc. Write for list. Radio Electronics Company, 143 North St., Waukesha, Wisc.

SWAP OR SELL—Transmitting tubes and condensers, all kinds of receiver tubes and parts. Sell or trade for test eqpt., manuals, crystals. Write for list. Johnson Radio Service, Box 224, Greeley, Nebr.

SWAP OR SELL—Transmitter parts incl. tubes, condensers, coil forms, meters, crystals, etc. Unused Radiart and Carter 6-135v packs, $5 ea. Also 12v packs. Want copies QST and Radio 1941-1947, also binders, service manuals, etc. E. S. Carter, 814 Craig St., Schenectady 7, N. Y.

WANTED—Concentric line type relay to operate on 110v a.c. 60 cy. for antenna change-over use. A. P. Rabito, 2835 Paris Ave., New Orleans 19, La.

WANTED—HQ-129, SX25 or other good amateur receiver. For sale: BC-211, spare tubes, calibration book and xtal, good condition, $50. Also BC-412 radar component, good condition, 5" 'scope without sweep, $48 f.o.b. H. G. Jackson, 412 Arbutus Ave., Manistique, Mich.

FOR SALE—Two Stancor P6157 plate transformers, 1500 or 1250v at 500 m.a D.C. Also a Meissner de luxe signal shifter-signal spotter combination, new. C. D. Eckhoff, W2LXL, 115 Gabriel Ave., Franklin Square, Long Island, N. Y.

WANTED—Radio magazines, QST, Radio Craft, Radio News, etc. before 1942 and the first 9 issues of CQ. Have three 832 tubes for trade or will sell for $10. Paul L. West, Box 722, Martinsburg, W. Va.

WANTED—Code practice machine with types. Must be reasonable and have all necessary parts, but need not work. A. J. Miller, Jr., 879 38th St., Richmond, Calif.

FOR SALE—83 issues Short Wave Craft, Short Wave & Television, Radio & Television (same magazine through successive name changes) from Nov. 1934 to Sept. 1941. Excellent condition. All replies answered. Veto M. Twaska, 3321 W. Carson St., Pittsburgh 4, Pa.

SWAP OR SELL—100TH, 35TG. Modulation transformer (PP 811 modulate 813). Vibrator power supply, 6v input, approx. 250v 100 milliamps output. Want Hi-Fi phono amplifier, 8-15 watts output; also Vibroplex bug. W2QUJ, 405 Weaver St., Larchmont, N. Y.

FOR SALE — Hammarlund Super Pro 400X, purchased new in Dec. 1946, used about 10 hours. Complete with power supply and cabinet speaker. Original packing. $300. Two Walkie-Talkies complete ready to operate, $40 each. Floyd Johnson, Hunter, N. Dak.

FOR SALE—Melehan Valiant dual pendulum full automatic mechanical key, used only few hours, $21—or will trade for other ham gear. Floyd Trueblood, W3LZC, 3341 17th St. N.W., Washington 10, D. C.

brated modulation meter should now be coupled to the output of the transmitter, and modulation from a sine wave source applied to the transmitter. A definite percentage of modulation, as read on the scope, should be used and the reading of the newly constructed unit compared by switching the meter to read both positive and negative peaks. If the readings agree with the oscilloscope or calibrated modulation meter, no further adjustments are necessary. However it is probable that there will be some discrepancy between the readings. The reading in modulation position may be increased by increasing the value of R_2, or reduced by using a resistor of lower value. It is highly probable that the correct value will lie in the range of 7500 and 15,000 ohms. The value will vary somewhat depending on the turns ratio and leakage inductance of the transformer used for T_1. In the instrument described, with a replacement type transformer of 3 to 1 ratio, the value of R_2 was 10,000 ohms. After every adjustment of R_2 it will be necessary to reset the carrier reference.

It is essential that during these tests, a steady source of audio be applied to the transmitter. Of course if the scale is hand calibrated, adjustments of R_2 are not necessary. However it does make the instrument much easier to use if the reference point and 100% modulation point agree.

In the event no scope or calibrated modulation meter is available for checking, a fairly accurate calibration may be obtained by setting the meter switch in the r.f. position, and adjusting the input to the reference point with no modulation applied. Modulation should now be applied to the transmitter, with the meter switch still in the r.f. position. The audio input to the transmitter should be increased slowly, at the same time watching the modulation meter. When 100% modulation is reached, the meter reading will change, indicating carrier shift. The meter may now be switched to either the positive or negative position and resistor R_2 adjusted to make the meter read 100%. For all practical purposes the meter will be sufficiently accurate if the transmitter modulation capability is reasonably linear.

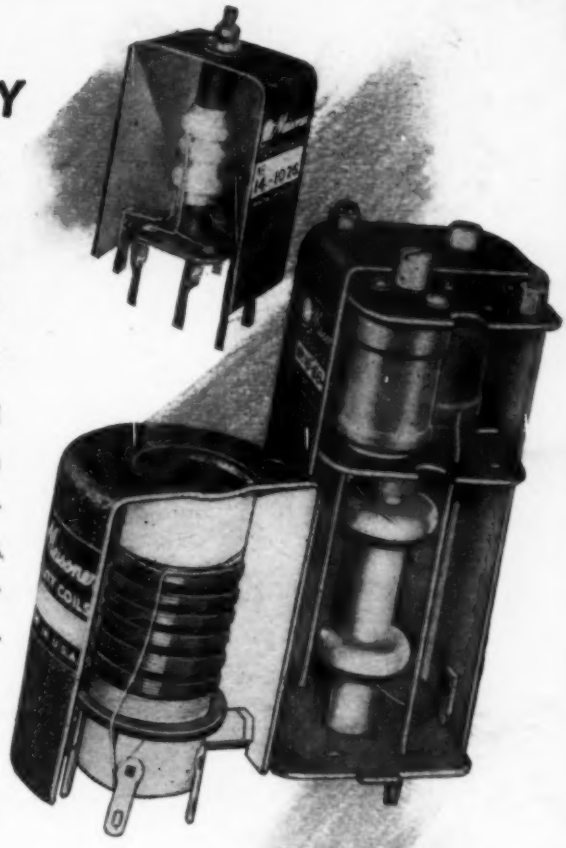
For use as a field strength meter, it is necessary to use a coil in the input circuit to attain sufficient sensitivity. For tests close to the antenna or when high power is used, it will be sufficient to use a short rod antenna connected to the "hot" end of the coil. For work at a greater distance, or when lower power is used, the use of a half-wave doublet is desirable. The feeders from this doublet should be connected to the antenna terminals of the instrument.

The meter may also be calibrated in relative db. if it is remembered that a doubling of the reading while adjusting the antenna indicates an increase in power of four times, or 6 db. For example, if the 25 mark on the meter is taken as zero db., the mark at 50 would indicate plus 6 db., 100 will be

(*Continued on page* 102)

MEISSNER

FOR TWENTY-FIVE YEARS THE STANDARD OF COIL QUALITY



For over a quarter century the name Meissner has stood for the finest in electronic equipment. Founded in 1922 by the late William O. Meissner (famous for his outstandingly successful inventions in communications and electronics) this company has been the source of many new developments in the radio field.

First to build a complete line of jobber coils; first to design and build plastic IFs and to introduce Ferrous IFs, Meissner has long led in the development of fine coil equipment for every application. A pioneer in FM (holding the second license issued in this country) Meissner was also the first to manufacture radio receiver kits. The Meissner Signal Shifter is still the Number 1 requirement for the complete ham shack and the Meissner Analyst has saved thousands of man-hours for servicemen everywhere.

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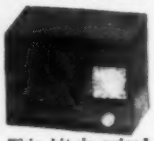
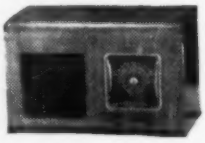
1947 — COMPLETE RADIO KITS



SENSATIONAL PEE WEE AC-DC KIT Model K-PW. Size 6½x 5x3½ inches. Very small in size; uses pee wee tubes 1R5, 1T4, 1S5 and 3S4 and new dry disc rectifier. Conventional superhet circuit with AVC; 2 gang condenser. Loop Ant. Receives broadcast 550 to 1700 KC. This set when wired according to our diagram will make a hot little personal radio. This kit is priced complete; just as all our kits are, with tubes, cabinet and speaker; nothing else to buy.....Net **$11.95**



5-TUBE AC RADIO KIT superhet circuit using new permeability tuning unit. Loop Ant. Covers broadcast 550 to 1700 KC. Beautiful walnut cabinet 12x7x 6. 5" A5 PM speaker. Everything complete, includes 6SA7, 6SK7, 6SQ7, 6K6 and 5Y3 and diagram Model K-5A.

Net **$16.95**

KIT K-7A 7 tube AC superhet 550 to 1700 KC. Has push-pull audio stage with tone control and 6½ in. alnico 5 PM speaker. Conventional circuit with AVC. Loop Ant. Similar in appearance to model K-5A, except has slightly larger cabinet. Everything complete including diagram and tubes 6SA7, 6SK7, 6H6, 6SN7, 2—6G6, 5Y3. A real value.....Net **$19.95**

NEW PLASTIC CABINET AC-DC SUPERHET KIT. Cabinet size 7x6½x10½". Attractive slide rule dial. 2-gang tuning cond. Receives broadcast 550 to 1650 KC. Has latest Alnico 5 PM speaker; Loop antenna; all parts, simplified diagram and Kit J-15 Dealtubes 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5 furnished. .....Kit P-48 Net **$12.95**

4 TUBE 1½-90 VOLT FARM RADIO KIT. Offered in same cabinet as the above Kit Model P-48. The same high gain broadcast superhet circuit. Complete with 4 tubes; 1R5, 1T4, 1S5, 3S4 and diagram. Less battery pack. Kit model PB-48. Your Cost **$10.95**

DELUXE AC-DC KIT J-D5 Beautiful walnut cabinet and all the parts to build a broadcast 5 tube AC-DC radio. Superhet with slide rule dial, 2 gang tuning condenser and loop aerial. Everything furnished; includes speaker and tubes 12SA7, 12SK7, 12SQ7, 35Z5 and 50L6 and diagram. Kit J-D5.

Net **$14.95**

OUR LEADER KIT $9.95. 2 gang cond. AC-DC 4 tube TRF kit 550 to 1600 KC Kit K-4R, a TRF job with a walnut cabinet and 5" alnico 5 PM speaker. All parts furnished; including tubes and diagram. Has direct drive dial and a very simple standard circuit. An ideal kit for the student or experimenter. Just a few hundred to sell .....Very Special at only **$9.95**

New 8 tube P. A.—Radio Kit PRK-8

Build this High-Fi Radio-Amplifier

- **Standard Broadcast Superhet 550 to 1650 KC**
- **New Positive Drive Permeability Tuner**
- **12" Dynamic Speaker**
- **Push-Pull 6V6 Output Stage 15 Watts**
- **456 KC I. F.'s**
- **Dual Tone Controls (Bass and Treble)**
- **Phono and Crystal Mike Inputs**
- **A Fine Power Amplifier and Radio Kit**
- **All Parts and Simple Easy-to-Follow Diagram Furnished**

Here is something new in radio. A real 15 watt power amplifier, with bass and treble controls. Has extra gain stage for crystal or dynamic mike. And on the same chassis, a standard superhet radio receiver. We furnish all parts, knobs, escutcheon plate and tubes: 6SA7, 6SK7, 6SR7, 6SN7, 6SJ7, 2-6V6, and 5Y3. No Cabinet. An actual photo of top and bottom of completed chassis makes wiring and assembly very easy.

Model PRK-8. Your Net.....**$24.95**

Crystal Mike and Stand $7.95 extra

20 WATT UTILITY AMPLIFIER KIT

Build this 20 watt utility 110 volt AC, 20 Watt power amplifier. Ready punched aluminum chassis, size 12 x 6 x 2½ inches. Has two input circuits, one mike and one phono. Mike stage has 135 DB gain, for crystal or dynamic mike. Has bass and treble controls. Designed for use with PM speakers; has 8-16 ohm output transformer. All parts, controls, transformers and easy-to-follow diagram furnished, including tubes: 2-6SN7, 6J5, 2-6L6GA, 5Z3.

Kit Model 20-LX. Net.....**$17.95**

12" G. E. 12 watt Alnico 5 PM speaker, $9.50 extra. Astatic crystal mike and desk stand, $7.95 extra.

LATEST IN PHONO-KITS

You can save money by assembling your own record players. All the kits listed below are complete; nothing else to buy. In 15 or 20 minutes any of these kits will be ready to sell to your customers.

*The model JT-5 high power push-pull 3 tube AC-DC amplifier is furnished with all record player kits complete; wired and tested and furnished with tubes and speaker. The push-pull circuit assures good base response even at low volume. For servicing convenience and connecting to pick-up, a schematic diagram is furnished.

KIT J-15 SINGLE RECORD PLAYER. Attractive ready cut walnut finished cabinet with latest 78 RPM phono motor and light weight crystal pick-up and *JT-5 push-pull AC-DC amplifier and 4" alnico 5 PM speaker. This player will surprise you in appearance and performance.

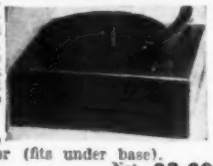
Kit J-15 Dealers.....Net **$13.95** complete

KIT J-16 AUTOMATIC RECORD PLAYER. Beautiful walnut finished, made to fit cabinet; latest single post automatic record changer and *JT-5 high power push-pull AC-DC amplifier (wired and tested) and heavy duty 5" alnico 5 PM speaker. This kit makes a deluxe home record player.

Kit J-16 Dealers.....Net **$29.95** complete

KIT J-16A. Same as J-16 except with leatherette base instead of walnut. Dealers....Net **$26.95** complete

KIT J-18 PORTABLE AUTOMATIC RECORD PLAYER. Beautiful portable leatherette case and latest single post automatic record changer and *JT-5 3 tubeAC-DC push-pull amplifier (wired and tested) and heavy duty 6" alnico 5 PM speaker. We have sold hundreds of these to our dealers and they keep coming back for more. A real value. Kit J-18 Dealers.....Net **$33.95** complete



KIT J-19 SINGLE RECORD ATTACHMENT. Attractive walnut finished base with motor cut out, latest 78 RPM rim drive phono motor and light weight, high output crystal pick-up. Easily attached to any radio or amplifier.

Kit J-19 Dealers.....

...Net **$9.95** complete

Model B-4 phono oscillator (fits under base).

Dealers .....Net **$3.69**

HOME RECORDER KIT J-K6.

Dealers.....Net **$59.95**

Consists of latest General Industries dual speed 33 or 78 RPM record-play-back mechanism. Beautifully made to fit walnut cabinet and a complete kit of parts to build a high quality recording amplifier with push-pull 6V6 outputs. All parts, tubes, 5" PM speaker, Astatic crystal mike and diagram furnished. This amplifier can also be used as a 15 watt PA system. Provisions made to connect 12" PM Speaker. (12" G. E. PM Speaker and wall baffle **$16.95** extra). Net Kit J-K6 **$59.95.** JK-6 in Portable Leatherette Case and 6" PM Speaker **$5.00** extra.

G.I. RECORDER MECHANISMS

Latest 1947 General Industries recording assemblies with 4 ohm magnetic cutters and crystal play back arms.

Model 12445—78 RPM. Net **$24.50**

Model 13700—33 and 78 RPM. Net..... **28.95**

Model 13810—Automatic changer with cutter, 78 RPM. Net..... **40.10**

RADIO-PHONO COMB. KIT

Build this beautiful portable combination radio phonograph. We furnish everything. Beautiful two tone portable case, latest rim drive phono motor, Astatic crystal pick-up. All parts to build high quality 5 tube AC-DC radio. Tunes broadcast 550 to 1650 KC, has tone control, loop antenna, 6" Alnico 5 PM speaker. Tubes 12SA7, 12SK7, 12SQ7, 50L6 and 35Z5. Simple diagram furnished. Kit Model RP-12.....Your Cost **$29.95**

Kit J-17 PORTABLE SINGLE RECORD PLAYER Offered in the same case as the Model RP-12 shown above. Has latest 78 RPM rim drive phono motor and light weight crystal pick-up and push-pull AC-DC amplifier. *JT-5 (wired and tested) and 6" Alnico V. PM speaker.

Kit J-17.....Dealers' Net **$19.95** complete

WALNUT CABINET RECORD PLAYER

Beautifully made, highly polished walnut cabinet with hinged lid. Plays 10" records with lid closed. Latest rim drive phono motor and high output. Astatic crystal pick-up. High power 1T-5, push-pull 3 tube AC-DC phono amplifier (wired and tested). Heavy duty 4" Alnico 5 PM Speaker. Single record player kit.

Model WL-3.....Your Cost **$19.95**

SMALL RADIO-PHONO KIT

After carefully designing the record player and cabinet shown above (Model WL-3), we decided that it should also be offered as a radio-phono combination. The cabinet is both attractive and small (12x12x8). The radio kit part of this unit is similar, except for the dial, to our Kit Model KP-48 shown in column 1 of this page. We furnish all parts, tubes, phono motor, pick-up, etc. Easy to follow diagram.

Kit Model WL-3R. Net.....**$29.95**

3-WAY PORTABLE KIT

Build this powerful, 5-tube, 3-way portable kit. Operates on 110 volt AC or DC or self contained batteries. Receives broadcast 550 to 1650 KC. Incorporates a standard superhet circuit with A.V.C. and loop. Has 5" Alnico 5 PM speaker, 2 gang condenser. All parts, batteries and diagram furnished, including tubes: 117Z6, 1R5, 1T4, 1S5 and 3S4. This kit was engineered too late to show a picture of the attractive portable walnut cabinet, which is approx. 7 x 9 x 4½ inches. A real kit. Remember, we furnish everything.

Kit Model 3-ZA. Your Net.....**$17.95**

BATTERY RECORD PLAYER

Something new in portable record players. Has spring wound phono-motor. Latest type light weight crystal pick-up, and ready wired and tested push-pull 3S4 amplifier. Furnished with a heavy duty Alnico V PM speaker. This kit can be put together in a few minutes time and will make a swell record player with superb tone and volume. Requires no AC power. Operates on self contained batteries. Priced complete with batteries and tubes, ready to assemble. Dealers' Net Model AK 10.**$19.95**

PHONO-OSCILLATOR 2-TUBES

NET $3.69

Complete, wired and tested. 800 to 1500 KC. Model B-4. Has audio gain stage for proper power output. Complete with tubes ready to operate..**$3.69**

MIKE-OSCILLATOR

800 to 1500 KC

Mike Oscillator model C-4. Not only does the unit work as a phono-osc., but has added gain stage for a crystal mike. Priced complete, wired and tested with 3 tubes and fader control.

Net **$4.95.** Crystal Mike.....**$4.90** extra

DELUXE MIKE OSCILLATOR

800 to 1500 KC Phono-Mike Oscillator. Makes any receiver a PA system. Record player or Recording amplifier. 3 stage high output unit with power transformer for AC operation only. High gain input stage for crystal or dynamic mike. Control on panel for fading recording to voice, simulating an actual broadcast station. Used by dealers and servicemen for demonstrations, tests and for home entertainment. Model DL-5 Complete with 3 tubes, wired and tested.

Net **$7.95.** Crystal Mike.....**$4.90** extra

DETROLA CHANGER $14.95

Very Special. Detrola automatic changer (plays 12 10-in. or 10 12-in. records). New and factory cartoned. Dealers' net $14.95. Attractive walnut made to fit base.

Net **$2.49**

Model B-4 Phono osc. fits under base...**$3.69** extra

VOLUME CONTROLS

Here is a red hot item for the service man. Manufacturers' type volume controls with 2½ inch shaft. Plenty of stock on hand. This is the type of control that you use every day. Order a good supply.

500,000 ohm Audio taper and off-on switch.

Each **49c**

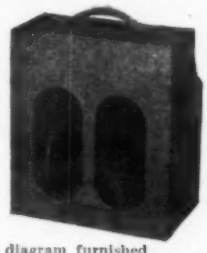
500,000 ohm Audio taper and DPST switch for battery and 3 way portable sets.....Each **59c**

McGEE RADIO COMPANY *Write For Catalog* *Send 20% Deposit — Bal. Sent C.O.D.* 1225 McGEE ST., KANSAS CITY, MISSOURI

BC-654 TRANSMITTER RECEIVER NET $16.95

Portable voice and CW transmitter and receiver for portable, mobile, and fixed station operation. 7-tube superheterodyne receiver with 3.5 microvolt sensitivity on voice and 0.5 microvolt sensitivity on CW, and 100 milliwatts undistorted power output. 455 KC IF. Uses 3—1N5GT, 1—1A7GT, 2—3Q5GT, 1—1H5GT tubes. 6-tube transmitter with antenna tuning network, Colpitts thermal compensated oscillator, class C final with 2—307A tubes in parallel, and crystal oscillator for checking frequency every 200 KC. 25 watts output on CW and 11.2 watts output on voice. Frequency range, transmitter and receiver, 3800 to 5800 KC. Ideal for Hams! Comes complete with cover; set of tubes installed, 5 spare tubes and 3 spare pilot lights. Less power supplies. These units are used but in good condition. Shipping weight 50 lbs. Net price with all tubes and spares **$16.95**
NET price, less the 1½ volt receiver tubes but with trans. tubes..... **$12.95**

MUSICAL AMP-KIT



Build this 10 watt AC-DC musical amplifier. Designed with the new selenium rectifier in a unique voltage doubler circuit. Has gain stage for crystal or dynamic mike and Inputs for instrument or phono pick-ups. Variable tone control. Priced complete with 12" speaker and case as shown and tubes 2—50L6, 12SL7, 12SJ7. All parts, rectifiers and punched chassis and wiring diagram furnished. Kit Model MM-10..... Net **$22.95**
Crystal Mike and desk stand..... **$7.95** extra

20-WATT PORTABLE AMP KIT

Build this 20 watt portable public address system. We furnish all parts and an easy to follow diagram. Attractive leatherette 3 piece case (snaps together to form one package). Has 12 Alnico 5 PM speaker. Inputs for mike and phono pick-up. Tone control. Full 150 mill power transformer. All parts, resistors, controls and condensers and tubes furnished. 5U4, 2—6LGA 6SC7, 6SH7. 25 ft. of speaker cable included. Amplifier Kit model XX-20 with one 12" PM speaker **$34.95**
With two 12" PM speakers. Net..... **43.95**
Crystal Mike and 20 ft. of cable. Extra... **7.95**

20-WATT FLUORESCENT KIT

All parts furnished but not wired to build a 24 in. 20 fluorescent strip light. All General Electric parts. Metal shell is white enamel (baked).
Very Special **$1.95**
20 watt fluorescent lamp..... **60c** extra

GERMICIDAL FIXTURE

Not a kit but a compete 15 watt wall type mounting fixture. Metal reflector is finished in baked white enamel. Priced complete with a General Electric 15 watt Germicidal lamp. Used not for light but for its germ killing effect. Fight air borne infections. Hang one of these above your work bench or in kitchens, bed rooms, etc. Offered at the very low price with lamp dealers. Net **$7.95.** A $12.00 value.

SENSATIONAL 4-PRONG VIB. SCOOP

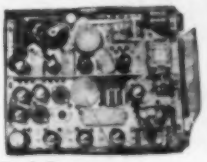
Genuine UTAH NP-42 4 prong 6 volt vibrator. This is the reg. type and size, just like you use every day. Fits Philco and many others. Very special.
Net **$1.29**

Output 1 volt, high imp. frequency response above 8000 cps. There is no metal from sapphire needle tip to crystal. Permanent sapphire tip needle (replaceable). Replaces any old style crystal or magnetic pick-up. Less record scratch and undesirable record top talk. Price with sapphire needle. A $10.00 value. Dealers' Net..... **$5.95**
Extra sapphire needles..... **$1.50** each

450 M. C. BC-645 15-TUBE I. F. F.

Easily Converted to a Voice—CW—Transmitter—Receiver

MADE BY GENERAL ELECTRIC



★ Factory Printed—Conversion Diagram
★ New ★ Pictured with Cover Removed
★ With 15 Tubes. NET $15.95. Two for $31.00

ANOTHER HOT WAR SURPLUS SCOOP

ARMY BC-645 I.F.F. UNIT. Early in the war, when radar picked up a plane, there was no way of knowing whether it was friendly or not. That was before BC-645 was invented. BC-645 sent out a signal that identified the plane as American. It probably saved more lives than any other piece of electronic equipment made. With some modifications the set can be used for 2-way communication, voice or code, on the following bands: ham band 420-450 mc., citizens radio 460-470 mc., fixed and mobile 450-460 mc., television experimental 470-500 mc. Equipment capable of doing the jobs of the modified set sells for hundreds and hundreds of dollars. The 15 tubes alone are worth more than the sale price. 4-7F7, 4-7H7, 2-7E6, 2-6F6, 2-955 and 1-We316A. It now covers 460 to 490 mc. Each BC-645 is shipped with a Belmont factory printed conversion diagram, showing how to make AC power supply modulator and how to make Transmitter and Receiver changes. Most Hams and experimenters already have the few parts necessary. New BC-645 with tubes less power supply. Shipping weight 25 lbs. Extra WE316A Tubes $1.29 each. 12 Volt Dynamotor **$4.95**

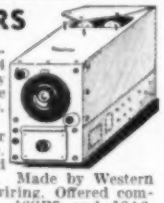
ARMY PARTS SALVAGE SCOOP NET $2.95. TWO FOR $5.00

Army PE-157 Vibrator type power supply, 2 volt-6 volt type. We have found no immediate use for this as a unit, but for salvage, it's a dream. Chuck full of transformers, resistors, condensers, relays, etc. One relay, which is a 10,000 plate type, is worth more than the sale price. Also there is a 4" heavy duty PM speaker with a dustproof waterproof cone and a handy dual section selenium rectifier rated at 1½ amps. Has a handy, usable hinged lid metal case, size 6x6x12. A red hot value priced less vibrators. Shipping weight, 20 lbs. 2,500 to sell.

WESTERN ELECTRIC AIRCRAFT SURPLUS

ALL OF THE RECEIVERS AND TRANSMITTERS LISTED BELOW ARE IN GOOD CONDITION. THE RECEIVERS ARE NEW, THE TRANSMITTERS ARE USED BUT GUARANTEED PERFECT. ORDER SURPLUS WITH CONFIDENCE FROM McGEE.

AIRCRAFT RECEIVERS

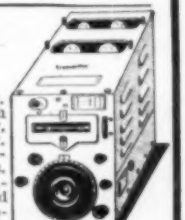


These Army surplus aircraft receivers may be operated from a 24 volt AC filament supply and any low power 250 volt B supply; or the tubes changed to the 6 volt type. There is plenty of room for a power transformer and rectifier tube; in place of the dynamotor. This receiver is very selective and sensitive; has RF stage and BFO. Made by Western Electric and you never saw finer wiring. Offered complete with tubes; 12K8, 3-12SK7, 12SR7 and 12A6, but less 28 volt dynamotor. Specify the frequency you desire. We have about 1500 available.

BC-454-B—3 to 6 MC superhet receiver with all tubes. Net..... **$5.95**
Less tubes. Net..... **2.95**
BC-453-B—200 to 500 KC superhet receiver with all tubes. Net..... **5.95**
Less tubes. Net..... **2.95**
BC-455-B—6 to 9 MC superhet receiver with all tubes. Net..... **5.95**
Less tubes. Net..... **2.95**
28 volt dynamotor (snaps on receiver chassis) Net **$1.95.** 3 for..... **5.50**
(Shipping weight of above rec. 8 lbs.)

Aircraft Transmitters

BC-457-A 4 to 5.5 MC
BC-458-A 5.3 to 7 MC



This really fits the ham's dream. Ideal for a 55 watt transmitter with 575 volts at 250 MA plate supply, or VFO to drive a high power rig. It's a companion unit to the 454-455-453 series aircraft receivers. Made by Western Electric and really rugged. The oscillator will hold the frequency, even under rough operating conditions. Has 1235 M. O. and 2-1625 (807) in parallel as final P. A.; or buffer to feed into a high power rig. Built in crystal dial calibration checker. Antenna loading inductance. Complete conversion data to VFO or FM oscillator is covered in CQ magazine; May '46 issue. Why not use this for your VFO? It's a real buy. 1000 to sell; at the ridiculous price; with tubes.

BC-457-A Transmitter 4 to 5.5 MC. Complete with 4600 KC crystal and tubes.....Your Cost **$9.95**
BC-458-A Transmitter 5.3 to 7 MC. Complete with 6200 KC crystal and tubes.....Your Cost **$9.95**
Special. Both of above on shock mounting rack **$18.95**
2" 0 to 10 antenna current meter in case; ideal for loading above transmitter.....Each **$2.49**
Transmitter shipping weight, 12 lbs.

BC-456-E Western Electric Modulator Unit

Companion unit of BC-457-A and BC-458-A. Complete with 1235 and VR150 and 1325. Gives necessary output to modulate above transmitters. We have a few more modulators than transmitters and are offering them at a ridiculously low price. You can salvage many parts from this modulator unit. Offered complete with tubes. Very special **$2.95.** 3 for **$7.95.**
Dynamotor 28 volts input; 250 volts 160 MA output continuous. Snaps on modulator **$2.95** each; 3 for **$7.95.**

12" G. E. SPEAKER

7 oz. Alnico 5.
List $16.50..... Net **$9.50**

4-TUBE AMPLIFIER ONLY 99c

4 TUBE AMPLIFIER (2-7C5, 7F7, 7Y4). Used as electronic supercharger control, 110V, 400 cycle. Contains: power trans., 7 condensers (mica and oil), 7 resistors, 4 loctal sockets plus other components worth many times the price. Black crackle finish, fitted slide-in chassis. 8¾"x4½"x3¾". Less tubes. Net **99c**

NAVY RBZ RECEIVER

RED HOT. We have about 200 of the navy miniature portable short wave receivers left, covering 2 to 5.5 M.C., offered complete with batteries and head phones and canvas carrying case. We will also include a 5 to 13 M.C. tuning unit which can be wired in. Very special all for only..... **$14.88**
Shipping weight 7 lbs.

McGEE RADIO COMPANY

Write for Catalog

Send 20% Deposit — Bal. Sent C.O.D.
1225 McGEE ST., KANSAS CITY, MISSOURI

plus 12 db., etc. In this manner an accurate picture of antenna adjustments in relation to actual power will be obtained. Most communications receivers are calibrated so that each "S" unit represents 6 db. When it is realized that very often one "S" unit means the difference between an unreadable signal and a 100% QSO, the advantages of a good antenna may be easily seen.

It should be pointed out that the use of the surplus radar type crystals currently being sold is not satisfactory in this application. These crystals are very delicate and easily burned out in the presence of a strong r.f. field, and in general are rated at one milliampere maximum current. It is very easy to exceed this value in an instrument of this type.

-30-

Spot Radio News

(*Continued from page* 20)

sioners, and the cross-examiners—all had microphones within easy reach. We kept hoping the mikes would break down, considering the galaxy of experts present, but they worked swell under the watchful eye of an FCC operator. . . . As long as we spent so much time on this, we think we're entitled to guess the verdict. Our bet: CBS will get a favorable decision. Reasons: FCC's policies of encouraging competition and particularly new developments.

WE PROMISE TO DIAL to a quiet, non-technical FM-AM program after one last set of items on television, also non-technical. Seems that in spite of all the backing and filling in the color brackets, black-and-white looks forward to a big season. Delayed by the uncertainty surrounding the FCC hearings, it is now going strong, with a number of attractive buys offered. A table model can be bought for as little as $150. *General-Electric, Stewart-Warner, Farnsworth, DuMont, RCA* and *Viewtone* are all in the market with sets ranging from table models in the $200-$300 class to combination consoles TV-FM-AM-phonograph and (could be) hot and cold toddy attachments—ranging to more than $3000. Larger screens—*U.S. Television* is concentrating, for example, on 21½"x 16" super-duper projection sets—are being favored. Programming is also improving, although spot-news coverage is still in the dream stage unless ample advance preparations can be made. It took three days recently for *DuMont's* WGGT to set the stage for a telecast from Washington Cathedral, two days for studying floor plans, seating arrangements, and other program problems, a third for getting equipment in shape.

CAMPAIGN ACTIVITIES in the "Radio-in-Every-Room" 1947 drive of the Radio Manufacturers Association seemed destined to get going full speed by early spring, following late-winter approval of details as outlined by John S. Garceau, of Ft. Wayne, Ind., chairman of the RMA advertising committee, to RMA's Board of Directors. Special emphasis will be given to the drive at the Radio Parts Industry Trade Show, May 13-16, at the Stevens Hotel, Chicago, and at the annual convention and industry conference of RMA, June 10-13, same place. All-out advertising activities are expected to show up early in the fall, reaching a climax during National Radio Week.

RMA, IN CONTRAST TO MANY ANOTHER industry, made history early in the spring by coming out flatly against a cut in income taxes, much as it would benefit radio manufacturing executives. Nailing down the stand of the industry in a formal letter to Chairman Eugene D. Millikin, Colorado Republican, Joseph Gerl, chairman, and A. H. Gardner, vice-chairman of the RMA Excise Tax Committee, spoke for the Association: "Individually, members of our committee will profit more from an income tax cut than a decrease in radio excise taxes. But they prefer the latter because a slice in excise taxes would permit lower prices, greater sales and production, and more jobs in radio plants." The latter brought out the public-service side of the industry's activities: "It is a low-price, large-production industry," Gardner declared. "It developed by popularizing 'the poor man's radio'—the small table models which every family could afford. It grew by creating a national audience for radio broadcasting companies. Eighty-seven per-cent of the families in this country own radios. In fact, the radio field may almost be considered a quasi-public industry." With these things in mind, the letter to Congressman Millikin went on to say that RMA "cannot assure you too strongly that the radio industry regards the continuation of the 10 percent manufacturers' excise tax as a severe handicap for the immediate future. The present clamorous market for radios cannot last forever. Any Federal tax which raises prices and holds them at artificial levels is a direct blow to our industry—to manufacturers and broadcasters alike." . . . Mr. Gerl is president of the *Sonora Radio & Television Corp.*, of Chicago, Mr. Gardner president of the *Colonial Radio Corp.*, of Buffalo. "It seems to us," they concluded, "that where there is a choice of cutting income taxes or cutting excise taxes—the choice being dictated by budgetary considerations—that a cut in excise taxes would be preferable."

SHIPBOARD RADAR is making good. That's back of the recent announcement from FCC that five-year licenses on a regular basis will be issued for the operation of acceptable radar, instead of the one-year experimental permits formerly used. The new licenses were not available as this went to press, pending preparation of rules and regulations, but it seemed

NEW . . . Simpson Model 305RC Tube-Tester with "No Backlash"* Roll Chart

With the addition of the new Simpson "No Backlash"* Roll Chart to the 1947 version of our Model 305, this famous instrument becomes beyond question the finest tube-tester on the market in its price range. Read the description of this new Roll Chart in the panel below.

Model 305RC provides for filament voltages from .5 volts to and including 120 volts. It tests loctalc, single ended tubes, bantams, midgets, miniatures, ballast tubes, gaseous rectifiers, acorn tubes, Christmas tree bulbs, and all popular radio receiver tubes.

Like other Simpson tube-testers, the Model 305RC incorporates 3-way switching which makes it possible to test any tube regardless of its base connections or the internal connections of its elements. This method, the result of exhaustive research and expensive construction, protects the Model 305RC against obsolesence to a degree not enjoyed by competitive testers. No adapters or special sockets are required. In addition to having a complete set of sockets for every tube now on the market, this tester has a spare socket, to provide for future tube developments.

The Model 305RC has provision for testing pilot lamps of various voltages as well as Christmas tree bulbs. It tests gaseous rectifiers of the OZ4 type—also tests ballast tubes direct in socket for burnouts and opens. Has neon bulb of proper sensitivity for checking shorts. This tube-tester is fused, and has the latest improved circuit. It provides for line adjustment from 100 to 130 volts, with smooth vernier control.

Model 305RC is distinguished for its beautiful exterior. It has a two-tone metal panel in red and black on a satin-finished background. Sockets and controls are symmetrically arranged for quick operation. The large, modern, fan-shaped instrument has an exceptionally long scale. It has "good" and "bad" English markings, also a percentage scale for matching and comparing tubes. Cases, both portable† and counter style, are made of strongly built hardwood, durably and beautifully finished.

Size, 11"x11"x6". Wt. 10 lbs. Shipping wt., 15 lbs.
Dealer's net price, portable or counter model.....**$59.50**
For 60 cycle 115 volt current only.
For 220 volt or 60 cycle, add..... **7.50**
Standard Model 305, with book-type speed chart **49.50**

Counter Model 305RC. Same instrument as portable model, but set in fine walnut finished hardwood case, with tilted, easy-to-use panel.

†Finished hardwood cases are standard on portable models. When these are not available, the instrument is housed in attractive simulated-leather covered case.

*6 Exclusive Features Make This the Finest Roll Chart Ever Designed for Tube-Testers . . . . .

- **"No Backlash" feature of this Roll Chart automatically takes up all slack in the paper chart and, by keeping it in constant tension, makes it impossible to turn the selector wheel without turning chart. Gives precision selection at all times. Also prevents chart from tearing or getting out of alignment.**
- **Gearing is such that only 6 turns of selector wheel will run the entire length of the 12½ ft. chart.**
- **Easy to read. The clear Lucite window is just wide enough to show 2 tube settings, or both settings on a multi-purpose tube.**
- **Entire unit removable by taking out four screws. Just lift from receptacle to make new entries or install new chart.**
- **Chart ingeniously fastened to rollers, affording easy replacement and constant alignment.**
- **Rigid, light-weight construction. Gear driving mechanism incorporates heavy-duty precision brass gears and parts.**

SIMPSON ELECTRIC COMPANY
5200-5218 W. Kinzie Street, Chicago 44, Illinois
In Canada, Bach-Simpson, Ltd., London, Ont.

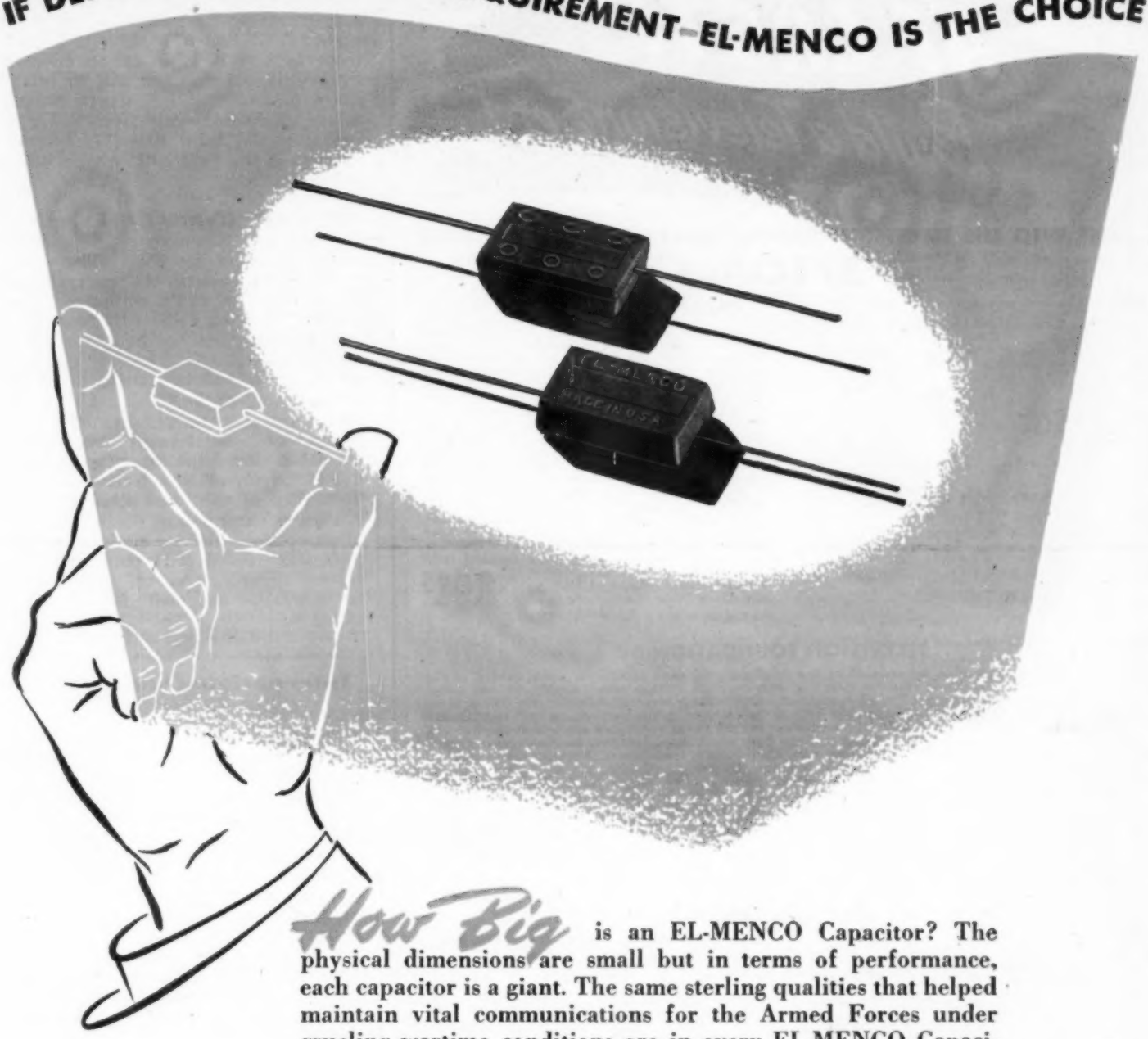
Simpson
INSTRUMENTS THAT STAY ACCURATE

certain that any ship desiring radar equipment would be able to install it on a permanent basis by the end of the summer. . . . Pending international standardization—FCC is "optimistic" that other nations will follow our lead —three frequency bands have been allotted. FCC emphasized in announcing them that the Commission is neutral as to their comparative worth in meeting ship radar needs. The bands are 3000-3246 mc., 9320-9500 mc., and 5460-5650 mc. Linked with these for shipboard purposes will also be the associated racon bands, 3246-3266 mc., 9300-9320 mc., and 5440-5460 mc. Commercial type merchant marine radar equipment is available in the first two bands and many experimental licenses which have already been issued are expected to be revised on the permanent basis. Boosters of radar in the 300-3246 mc. band say they get better visibility in all kinds of weather, while 9320-9500 equipment makers claim theirs best for navigating through narrow channels. The Commission granted the third (5460-5650) band on the chance that it will combine the qualities of the other two. . . .

IF YOU WANT TO MAKE a pretty good odds-on bet, here's one worth thinking over; the Federal government, as represented principally by the War Assets Administration, Army and Navy, should be out of the electronics market permanently by fall. A number of factors seem to point toward this conclusion. There are a great many war-built and war-used devices that have no peacetime application. A few of these are being drained off for specialized purposes—for instance, Sonar, the Navy's underwater sound-wave detection equipment, may be used to map the contours of the Great Lakes and coastal waters by the Coast and Geodetic Survey. But many others will have to be junked. Another factor that arose more recently — Army and Navy, threatened with stringent budget cuts, are holding on to remaining war surpluses and even taking back some that they released to WAA early in the year. Copper wiring is a notable item in this list. In the third place, there is a huge backlog of potential purchasers, principally veterans, waiting to snap up anything useful that re-

"And this set incorporates our new 'Lighthouse' tube!"

IF DEPENDABILITY IS THE REQUIREMENT—EL-MENCO IS THE CHOICE



How Big is an EL-MENCO Capacitor? The physical dimensions are small but in terms of performance, each capacitor is a giant. The same sterling qualities that helped maintain vital communications for the Armed Forces under grueling wartime conditions are in every EL-MENCO Capacitor that goes into your circuit.

We who design and make EL-MENCO Capacitors are proud of the reputation of dependability that our products have earned. We pledge our every effort to its continuance.

THE ELECTRO MOTIVE MFG. CO., Inc. Willimantic, Conn.

ARMY NAVY

Foreign Radio and Electronic Manufacturers communicate direct with our Export Department at Willimantic, Conn. for information.

MOLDED MICA **El-Menco** MICA TRIMMER

CAPACITORS

mains on the WAA sales list. Test equipment typifies this kind of material. Still short in the civilian market, largely owing to lack of supplies to make it, it has a backlog at WAA more than twice what can be covered by available surpluses. All in all, if there is anything left worth buying in the electronics field from WAA by the time the snow flies, Washington experts in the field will be very much surprised.

AIRCRAFT RADIO RULES, of special interest to amateur fliers, were issued recently by FCC. The Commission emphasized the necessity of all pilots with radio equipment registering or being subject to fines. Most routine questions can be answered at airports or field CAA offices. For special queries, you can write the FCC, Washington, 25, D. C. . . . Also as an aid to pilots interested in radio is an equipment booklet being prepared by the RMA under the direction of Samuel P. Taylor of New York and F. C. McMullen of the same city. Mr. McMullen is chairman of the RMA's aviation section. RMA's engineering department developed standards for testing flight equipment. The booklet is specially designed for amateur pilots.

—30—

International Short-Wave

(*Continued from page* 68)

The cooperative system has worked throughout Finland for nearly 40 years—and with marked success. In 1939 there were more than 7000 cooperatives with a total membership exceeding 900,000 and they handled about 25 per-cent of the retail trade and approximately 40 per-cent of all the wholesale trade.

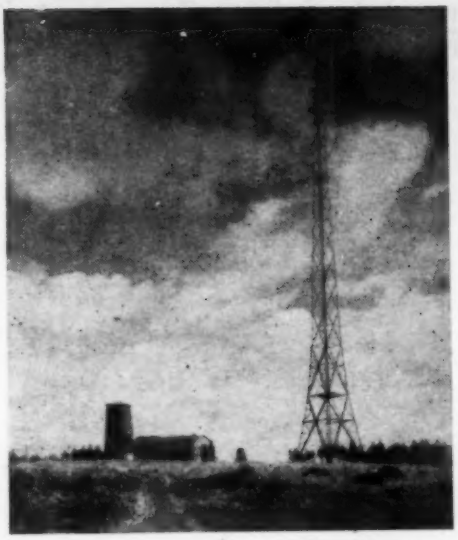
* * *

Sunspot Predictions, '47

In a recent issue of *"London Calling,"* official publication of the British Broadcasting Corporation, T. W. Bennington, of the BBC's Engineering Division, stated that "during 1947, it is likely that sunspot activity will continue its rapid increase and that the atmospheric ionization will continue to follow it in sympathetic progression. It is possible—indeed, probable—that the coming maximum of solar activity will occur in the latter half of the year, so that by next winter the atmospheric ionization will be at its highest for any time in the present sunspot cycle. The BBC will therefore have to make the greatest possible use of the shorter wavelengths.

"The indications are that the maximum, even if reached this year, will be a higher one than that of 1937, though all these points are rather uncertain ones."

Mr. Bennington stated that "the 11- and 13-meter bands will thus, as far as is possible, be made maximum use of this year. After that, if the maximum in sunspot activity does occur in 1947, the activity will begin to fall, and the



Antenna mast of the Finnish radio at Lahti. Programs from the s.w. transmitters of this country are widely heard in Europe and occasionally in America. Best bet from Finland for listeners in the U.S. is OIX4, 15.190 reported with English news nightly at about 7:15 p.m. to 7:25 p.m. EST.

usable wavebands begin to get longer. But the rate of progress in this direction will be much slower than was that towards the shorter wavebands, so we may expect that 'short waveband conditions' will continue until about the middle of 1950."

Incidentally, for some time now the BBC has been using the 11-meter band (GSK, 26.100) for its African beam; it is sometimes heard in the Eastern United States around 8 a.m.

* * *

Verifications

Direct from Robin Wood, program manager, comes this comment regarding verification by *Radio Australia:*

"A considerable number of DXers' reports have been of a very poor quality and do not warrant verification. I would appreciate it very much if you would pass on to various clubs and DXers generally, that a higher standard report must be submitted for checking with our logs. The following are examples which have been received within recent weeks:

" 'I heard your station VLG4, 25.37 metres on November 18. QSA2. Details of programme—music and song.' —From Sweden.

" 'I am collecting verification cards from different radio stations. Will you please be kind enough to send me your verification cards?'—From America.

"In each case we have acknowledged the listener's correspondence but confirmation of reception has been refused on the grounds that insufficient detail has been included in the reports. *DXers desiring verification cards should submit approximately 15 minutes program and reception data. Where stations are operating in parallel, separate reports covering different times should be submitted.* Many listeners simply say they heard *Radio Australia* on *several* wavelengths but the actual report covers *only one* frequency.

"Graham D. Hutchins who is in

charge of our Correspondence Section, and who is a DXer of longstanding, was instrumental in the formation of the Australian DX Club in 1932. He was surprised to see such poor-quality reports coming from overseas countries and has discussed this matter with me and also with the Postmaster-General's Research Department. It was decided to notify the various DX clubs throughout the world that *a better class of reports should be submitted* by members; *otherwise we will be unable to continue to issue verification cards."*

This statement from Mr. Wood should serve to bring about a better understanding as to the requirements necessary to obtain verification cards. The requirements of *Radio Australia* might be well applied by listeners in reporting to *any* s.w. station.

The BBC is no longer verifying! From Bryan Hayes, BBC local representative in England, comes this explanation: "The BBC verification plan is now closed owing to permission being withdrawn from the BBC. I therefore regret I shall be unable to verify any more reports on the BBC's behalf. I received notification on December 28 that they could not give me permission to verify reports. I believe this is due to the terrific amount of work involved between BBC Engineering and Monitoring Divisions and the large amount of labor involved in keeping the logs up-to-date."

In requesting "reception reports from listeners, amateurs and members of the various Shortwave Clubs," CBC's International Service says these "are of great assistance to the Engineering Department of the CBC International Service, Canada. Many of the difficulties involved in short-wave broadcasting can be anticipated, but on-the-spot observations of reception conditions provide a vital check on the theoretical predictions involved in the maintenance of an efficient service.

"Reception reports should include the average signal strength of our carrier at definite times, and should mention the frequency used and the amount of interference present. The source of interference should also be given whenever identification of the offending station is possible. The times at which our signals first begin to provide a satisfactory service, reach peak signal-strength and then fall below a satisfactory level would provide practical information which would assist us in checking our ionosphere predictions."

The CBC International Service sends out an attractive verification card. It publishes a monthly booklet, "This is La Voix du Canada," which is sent on request to listeners in any country. Address, Canadian Broadcasting Corporation, International Service, P.O. Box 7,000, Montreal, Quebec, Canada.

HH2S, 5.945, will verify; correct address is Societe Haitienne de Radiodiffusion, P. O. Box B-81, Port-au-Prince, Haiti. (Beach)

XTPA, 11.65, Canton, China, verifies

MONITOR *Crystaliner*

A Crystal Controlled Signal Generator for Universal Use

$69.50
COMPLETE
MODEL 201

TIME SAVING

No stabilizing warm-up period necessary.
Frequencies required for receiver alignment instantly selected.
No confused dial.

ACCURATE

All signals are crystal controlled —Accurate to .1 of 1%.

DEPENDABLE

Always in adjustment.
No variable condensers to wear.
No coils to age.
Dependable as the ageless crystal itself.

COMPACT

Occupies a minimum of bench space.
As light and portable as a Kodak

ATTENUATION

Efficient attenuator provided.
Maximum output approximately 10 volts.
Continuous attenuation through two ranges.

COMPLETE COVERAGE

Twenty-three direct crystal controlled frequencies (exclusive of harmonics) as follows:

175 KC, 262 KC, 370 KC, 455 KC, 460 KC, 465 KC, 470 KC, 600 KC, 1000 KC, 1400 KC, 1700 KC, 7000 KC, 7175 KC, 7262 KC, 7370 KC, 7455 KC, 7460 KC, 7465 KC, 7470 KC, 7600 KC, 8000 KC, 8400 KC, and 8700 KC.

This group of frequencies, plus their harmonics, allows hundreds of exact crystal controlled frequencies to be instantly selected, covering IF, broadcast, short-wave and the ultra-high frequencies.

MODULATION

Frequencies on dial and their harmonics may be modulated with a 400-cycle (crystal controlled) tone.

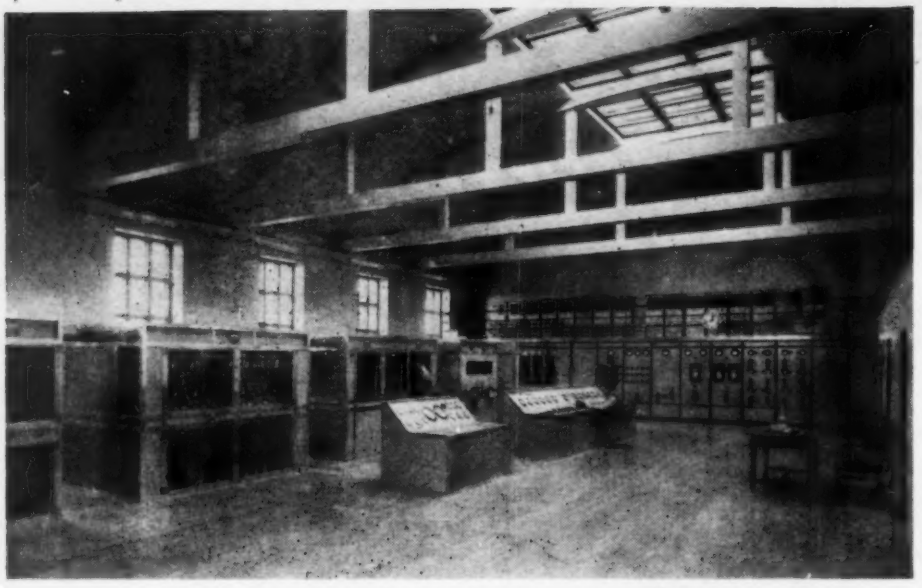
AC OPERATION

50-60 cycles, 110-120 volts.

Electrostatically shielded isolation power transformer.

Monitor Products
815 FREMONT AVENUE
SOUTH PASADENA, CALIF.

PRICE SUBJECT TO CHANGE WITHOUT NOTICE



The radio station at Lahti, Finland, OIX2, 9.500, Peri and OIX4, 15.190, are scheduled with English news at about 7:15 a.m. and at about 7:15 p.m. The best signal so far obtained here is the 15.190 on evening transmission.

with a white card, with large green call letters; power is 500 watts; signed by Director S. Lee for Canton Broadcasting Station of the Central Government Broadcasting Administration. (Cushen) It is suggested that listeners reporting to this station use this complete address: Radio Station XTPA, c/o Canton Broadcasting Station, Central Government Broadcasting Administration, Canton, China (Chine); mail addressed simply to XTPA, Canton, China, has recently been returned as "Unknown."

Address for *Polskie Radio* is Stalina 31, Warsaw, Poland. Veries are signed by W. Pawlak, Chief Foreign Liaison. (NZDXC)

VONH may be addressed in care of Broadcasting Corporation of Newfoundland, Newfoundland Hotel, St. John's, Newfoundland, or at P. O. Box E5372. Sends nice card. (Harts)

The Leipzig, Germany, transmitter verifies by letter; address, "Mitteldeutscher Sender," Springstrasse, Leipzig, N22, Germany. *(Radio Call)*

Address of the Northern Rhodesia station is ZQP, Information Officer, P. O. Box 209, Lusaka, Northern Rhodesia. *(Radio Australia)*

Address for *Radio Athens* is P. O. Box 117, Athens, Greece.

An attractive verie card has been received from *Radio Martinique*. (Znaidukas)

The Prague stations may be addressed, Cheskoslovensky Rozhlas, Praha 12, Stalinova Tr. No. 12, Czechoslovakia. (Loewy)

Address of *Radio Noumea* is Le Chef de Cabinet du Gouveneur, Directeur du Service de l'Information, Noumea, New Caledonia (Caledonie). (Riggle)

Reception reports for the Lourenco Marques stations should be addressed to Radio Clube de Mocambique, P. O. Box 594, Lourenco Marques, Mozambique (Portuguese East Africa). (Laubscher)

All India Radio has been asking for reports on reception of its new 13-meter band station (21.510); address, T. D. Chatterji, All India Radio, Kingsway, Delhi, India. *(ISWC)*

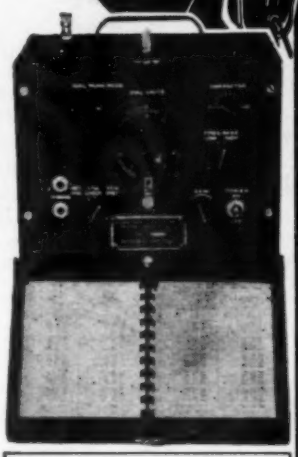
* * *

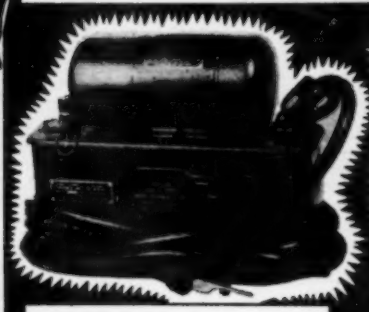
Radio Club News

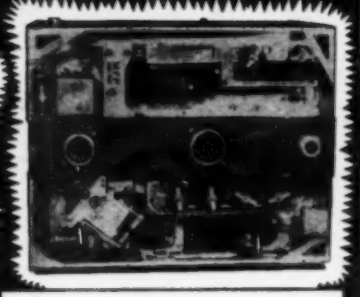
England—Edward J. King, 632, Green Lanes, London, N.8, England, has been named editor of the *"Short Wave Review,"* house organ of the

ESSE Specials!

THIS EQUIPMENT HAS BEEN REMOVED FROM SURPLUS AIRCRAFT—AND IS SOLD AS USED . . . . .







PE-103 DYNAMOTOR UNIT

Brand new. Used to power your field or mobile transmitter. Designed for use with the BC-654 transmitter and receiver. Input—6 V. DC 21 amps., 12 V. DC 11 amps. Output—500 V. DC 160 Ma. Filtered output. Hi-Current relay switches and overload protect switches self contained in unit. Shipped in original overseas moisture-proof containers. Weight of unit 53 lbs.

Price, Brand New..... **$8.95 ea.**

SCR-522 100-156 Mc. RECEIVER AND TRANSMITTER

One of the most interesting and useful pieces of surplus equipment. Designed for plane and ground station use, this unit offers remote control of any four pre-selected crystal controlled frequencies in the spectrum of 100-156 Mc. This spectrum covers factsimile, air navigation aids, airport control, railroad, police, urban telephone, as well as the amateur band 144-148 Mc. October Radio News gives details for converting the SCR-522 receiver section, BC-624.

Transmitter section, BC-625, is voice amplitude modulated and has an output of 8-9 watts.

Tubes used and included: 2—832, 3—12A6, 1—6Q6, 2—6SJ7, 1—12J5GT, 3—12SG7, 1—12C8, 1—9002, 3—9003, 1—12AH7GT.

Used, with tubes, less dynamotor and remote control.

Price ..... **$22.50 ea.**

Dynamotor for the above SCR-522:

Price ..... **$3.50 ea.**

TRANSCEIVER — REC. — TRANS. BC-620-H

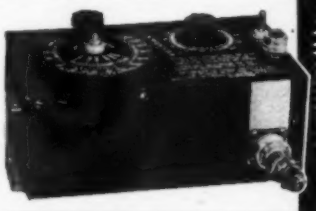
Portable, low power, frequency modulated. Range of approximately 5 miles. 2 channels, crystal controlled operation on any two of eighty different channels spaced 100 KC apart — range from 20-27.9 MC battery operated — either proper dry cells or 6 or 12 V. storage used with proper vibrator and power supply. 35 watt maximum output on 12 V. input. Complete as shown, with tubes — less crystals.

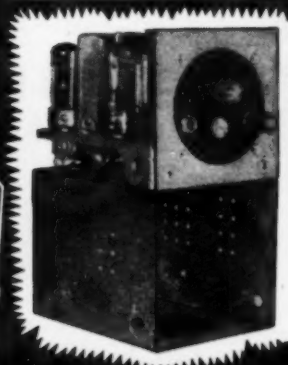
Price ..... **$49.50 ea.**

221 FREQUENCY METER

125-20,000 KC operation. Accuracy of .01%. Furnished complete with tubes, original crystal and calibration charts.

Price ..... **$34.85 ea.**

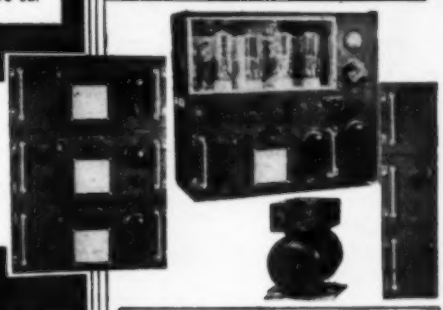




5-TUBE AIRCRAFT RECEIVER

200-400 KC operation.
Complete with tubes for 24 V. operation.

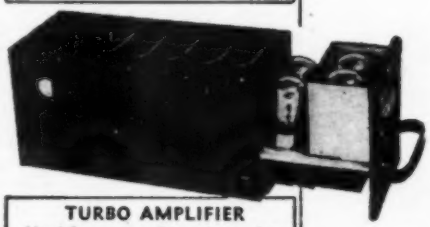
Price **$4.95**



INTERVALOMETER

Used to release bombs at pre-determined intervals—adaptable for use as a timing device in photography, etc.

Price ..... **$2.75 ea.**

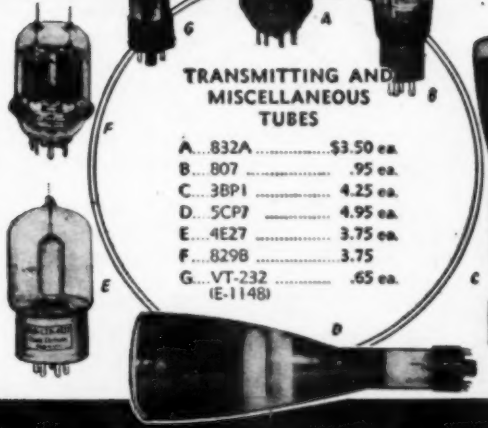


TURBO AMPLIFIER

Used for parts—shipped complete with the following tubes:

2.....7C5's
1.....7Y4
1.....7F7

Price ..... **$1.75 ea.**



TRANSMITTING AND MISCELLANEOUS TUBES

A	832A	$3.50 ea.
B	807	.95 ea.
C	3BP1	4.25 ea.
D	5CP7	4.95 ea.
E	4E27	3.75 ea.
F	8298	3.75
G	VT-232 (E-1148)	.65 ea.

Photos by PALMER

BC-375-E GENERAL ELECTRIC MOPA TRANSMITTER

Frequency range of 200-500 Kc. and 1,500-12,500 Kc. is covered by means of 7 plug-in tuning units furnished. By slight modification operation on 10 and 20 meters is possible. Oscillator is self-excited temperature compensated type. Power amp. is neutralized class "C" using 211 tube and is equipped with antenna coupling circuit to match practically any antenna. Modulator is class "B" using two 211 tubes. Power supply is 24 V. DC dynamotor which furnishes 1,000 V. at 350 Ma. A.

Transmitter output conservatively rated at 42.5 watts, phone 13 watts CW, but may be pushed to 150 watts.

Complete as shown with tubes, dynamotor, seven tuning units, and cable connector plugs. Removed from bombers, sold as used.

Price complete **$29.75**

TERMS:
CASH with ORDER or 25%
BALANCE C.O.D.
All Items Shipped Collect

ESSE Radio Company

130 W. New York St.- Indianapolis 4, Ind.

British Short-Wave League. All reports for this club should be sent direct to Mr. King.

United States—Bill Howe, Washington, D. C., has given up the editorship of the short-wave division of *"Universalite,"* house organ of the Universal Radio DX Club, due to other commitments. He has been replaced by Lee Neidow, Jr., 1611 Grace Street, Chicago 13, Illinois, U. S. A. Our best wishes go to Mr. Howe who did a splendid job for URDXC, and we say "good luck" to Mr. Neidow.

* * *

Listeners' Annual

Most interesting publication that has come to my attention yet this year is *"The Shortwave Listeners' Annual"* (1947), just published by the Amalgamated Short Wave Press, Ltd., 57, Maida Vale, Paddington, London, W.9, England.

Compiled by A. C. Gee (G2UK), C. W. C. Overland (G2ATV), W. N. Stevens (G3AKA) and the Monitoring Department of *"Short Wave News,"* this listener's guide book of about 80 pages is being sold through booksellers in Britain at 2s. 6d., and may be had direct from the publishers for 3s. 0d., postpaid.

Main headings are: Your Guide to the Short Wave Spectrum; Short Wave Reporting; Commercial W/T Section; Amateur Codes and Abbreviations; Broadcast Station Addresses; Identification of Short Wave Stations; Propagation of Short Wave Radio Waves; and Short Wave Broadcast Station List. Miscellaneous features include Mileage Table; DX Time Table; Local Time Conversion; and Wavelength/Frequency Conversion Chart.

The Annual is the most comprehensive of its kind I have yet seen, and it should prove of material assistance to those who secure a copy.

The publication was made possible through the close cooperation of members of the International Short Wave League, which group is associated with *"Short Wave News."*

* * *

This Month's Schedules

Albania—ZAA, 7.852, *Radio Tirana,* is reported heard afternoons to around 4:30 p.m. closedown; British correspondents still list *English* news for 3:15 p.m., but monitors on this side of the Atlantic say *no English is now noted.*

Algeria—Radio Algerie, 11.835, Constantine, appears to close its transmissions at 3:15 a.m. and 7 p.m., respectively. (Beck)

Andorra—Radio Andorra, 5.980 (varying), is scheduled 7-9:30 a.m. and 2-8 p.m. now; has *English* session daily, mostly music, 4-4:30 p.m.; reports in this period may be sent direct to Freemantle Overseas Radio, Ltd., 18, Park Street, Park Lane, London, W.1, England. (Harrison)

Angola—By airmail from Mervyn Laubscher, South Africa, comes this information regarding "a new Portuguese station on 42 meters, announc-

ing as Radio Clube de Malanje, Angola. The town of this name is the railway terminus 250 miles directly inland from Louanda. Frequency appears to be about 7.140; this is quite possible as they are just below Beira; schedule seems to be 1:30-3:30 p.m., but I am not sure that this is a daily schedule."

Arabia—A letter dated December 24, received by Grady C. Ferguson, North Carolina, from ZNR, Aden, states: "The station was a wartime measure mainly intended for broadcasting authentic news to the neighboring countries of Yemen, Somaliland, and Ethiopia in Arabic, Somali, Gujerati, Hindustani, Italian, and French, with an aerial power of about 2 kilowatts. It was of particular value when the countries on the west side of the Red Sea were in enemy hands, *but the broadcasts have been discontinued.*"

On the other hand, New Zealanders report ZNR has been heard testing to 10 a.m. on 6.765 with 5 kw., and announcing 12.110 as in parallel. (Cushen) It may be that ZNR intends to resume broadcasting activities on a regular basis sometime in the very near future.

Australia—Radio Australia has announced that VLA9, 21.60, is now being used to Britain between 2 and 3:15 a.m., and that VLA6, 15.20, parallels but signs off at 3 a.m. VLB3 is off. (There may be a mistake regarding this use of VLA9 since there is actually only one VLA transmitter; while *Radio Australia* has announced the use of VLA9, the 13-meter band station is probably VLB8, 21.680) It is announced that the West Coast beam, 11:45 p.m.-12:45 a.m., is now carried over VLA6, 15.20, VLB3, 11.77, and VLG7, 15.16, and to South Africa on VLC9, 17.84; it is likely that VLA6 (100 kw.) will shortly replace VLG7 in 15.16 to avoid QRM. VLA8, 11.76, is now off in this transmission. (Balbi) Some nights I have noticed that 9.615 parallels for this period, but may be off by this time.

VLC4, 15.32, and VLG7, 15.16, are used to New Caledonia, 2:30-3:45 a.m.; VLG3 is off. (Balbi)

Azores—From Sweden comes a report of a station which Swedes list with the call of CSX2, on about 4.850, location is Ponta Delgada, with call of "Emissora Regional dos Azores"; heard around 4:50-6:30 p.m., mostly music. (Skogsberg)

Bechuanaland—In verifying for Rex Gillett, Australia, ZNB, 5.900, now scheduled to 2:30 p.m. sign-off and with *English* news relay from the SABC at 12 noon, it was explained by A. P. Brittz, station technician, that "ZNB is primarily the control station for numerous communication stations up-country in the Bech. Protectorate where there is no telephone communication or telegraph. We average two schedules per station every day. All traffic handled is passed through ZNB which disposes of the stuff to the local Post Office and other channels. Dur-

ing our spare time we broadcast records only, viz. between 1 and 2 p.m. and again between 7 and 9:30 p.m. South African time (6-7 a.m. and 12 noon-2:30 p.m. EST), and have about 9000 records. Our input is only 200 watts and most of our country stations run at 50 watts. Antenna here is half-wave delta matched impedance, feeders 600 ohms. This station is very popular in South Africa mainly because we do not have set programs like all the SABC stations do. In other words, we play anything we can lay our hands on. Listeners never know what to expect!" Address is Box 106, Mafeking, Bechuanaland. Mr. Gillett says verie is nice, colorful card.

Belgian Congo—OTM2, 9.380, *Radio* Congo Belge, Leopoldville, is being heard around 4 p.m. in Sweden. (Akerren)

British Honduras—Bill Arthur, Charleston, West Virginia, reports picking up ZIK-2, Belize, a recent Sunday afternoon at about 1:35 p.m. on 10.60 (announced); had good signal but heavy CWQRM; immediately following an *English* newscast, signed off at 1:48 p.m.

Burma—Radio Rangoon seems to have replaced 9.543 with 6.035 for the *English* transmission, 8:40-10:15 a.m. (Dilg) *English* news is at 8:45 a.m. and headline news is read about 10:10 a.m., followed by preview of next day's program. Official schedules received direct from Rangoon list headline news for 9:30 p.m. on 9.543, and news at 2:30 a.m. on 6.035.

Canada—On February 25, the International Service of the Canadian Broadcasting Corporation, Canada's nationally owned short-wave broadcasting organization, observed its second birthday. During two years of operation, the Service has expanded steadily and now provides regular programs in ten languages. In connection with its anniversary, the Service announced "it will continue to expand, bringing the Voice of Canada to ever-increasing numbers of listeners in other lands."

Latest schedules received are:

To Great Britain and Europe—CKNC, 17.82, 9 a.m.-3 p.m. daily, and 7 a.m.-3 p.m. Sundays; CKCX, 15.19, 9 a.m.-12 noon daily, 7 a.m.-12 noon Sundays; CKCS, 15.32, 12:05-1:30 p.m. daily; CHOL, 11.72, 3:15-6 p.m. daily; and CKLO, 9.63, 4:45-6 p.m. daily. News is scheduled for 2:15 and 4:45 p.m. each day.

To Caribbean and Latin America—CKRA, 11.76, 6:20-7:35 p.m. daily and 6:20-9:05 p.m. Sundays; CKCS, 15.32, same schedule. News begins the broadcast (around 6:30 p.m.), following program preview.

Direct from our monitor in Nova Scotia, Albert W. Adey, comes this complete schedule of CHNX; operating on 6.130, CHNX, Halifax, relays CHNS (960 kcs.), 6:30 a.m.-11:15 p.m. Newscasts are scheduled for 7, 8, 9:30, 10:55, 11:30 a.m., and 12:45, 3:15, 5, 5:30, 5.55, 7:55, 11 p.m.

Canary Islands—Radio Tenerife,

ARROW has the VALUES!

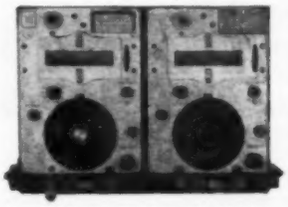
now offers the

FAMOUS COMMAND SET

ARMY SURPLUS — Principal Components of RADIO SET SCR-274-N

Includes 2 transmitters, 3 receivers, 1 modulator, 4 dynamotors, control box, etc.

Original Cost Over $600.00— now complete for ONLY



$34.95

RADIO TRANSMITTERS

BC-457-A	BC-458-A
4—5.3 mc	5.3—7 mc
Ind. cost	Ind. cost
$10.95	**$10.95**

RADIO RECEIVERS

BC-454-A	BC-453-A	BC-455-A
3—6 mc	190—550 kc	6—9.1 mc
Ind. cost	Ind. cost	Ind. cost
$6.95	**$8.95**	**$6.95**

MODULATOR UNIT

BC-456-A Ind. cost..... **$6.95**

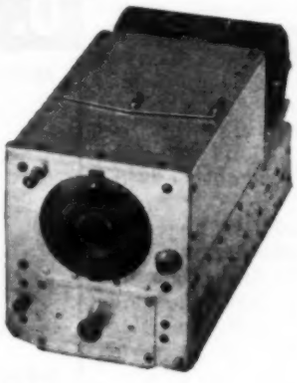
A BUY YOU CANNOT OVERLOOK! ORDER AT ONCE!

These components are practically new and have had ferry time only . . . complete with tubes . . . original cost over $600.00 . . . this tremendous value for only $34.95 complete . . . **less than the tubes originally cost!** Individual cost of dynamotors, $1.95 each . . . Ind. cost of Remote Control Unit (BC-450-A) $2.95.

COAXIAL CABLE

26 Ft. of COAXIAL CABLE RGU8, 52 ohm. with 2 amphenol plugs, one at each end.....ea **89c**

ARMY AIRCRAFT RECEIVER
Model BC-946-B



Broadcast Band from 520 to 1500 kc. Tube complement: 3—12SK7, 1—12SR7, 1—12SN7, 1—12A6, & 1—12K8. Designed for dynamotor operation but is easily converted to 110 or 32 volt operation. Has two I.F. stages and three gang condenser Comes packed in sealed carton complete with tubes and instruction manual, but less dynamotor..... **$12.95**

Dynamotor D M 32A.

Each..... **$1.95**

HEADPHONES

Signal Corps, 8000 ohms and 200 ohms, each..... **$2.49** 2000 ohms, Trimm, each..... **$1.79**

POWER TRANSFORMER—NAVY TYPE

159 ma; 6.3V at 6.5 amps; 5V at 3 amps.....Each **$3.29**

SURPRISE PACKAGE

For the experimenter, radio serviceman, handy man, repairman, "ham," hundreds of valuable miscellaneous radio parts. 10 pounds..... **$1.59**

ANTENNA

10½ foot sectional antenna, collapsible. AN-131A..... **$1.29**

Wholesalers, dealers, institutions, and other quantity purchasers . . . write, wire, phone for quantity prices.

BRAND NEW TUBES

304TH	$7.95	6AG7	69c
12SK7	49c	50L6	69c
5Y3	43c	6AG5	59c
6SJ7	49c	2X2	79c
12SH7	49c		

SPEAKERS

5" PM speaker	$1.19
4x6 dynamic	1.65
5x7 PM—Heavy slug	2.15
12" dynamic 1000 OHM FIELD	5.95

HICKOK 2½" 0-150 Volt AC Voltmeter
Each..... **$2.49**

3½" AUTOMATIC TIME METER

60 cycle 110 volts. This time meter consists of a cyclometer driven by a Telechron synchronous motor. Connect to an electric circuit; it will measure and indicate the number of hours or minutes that the circuit is in use. Shpg. wt., 61 lbs.—list $17.00.
Your cost..... **$4.95**

PLUGS

PL55 Plugs.....each **20c** PL68 Plugs.....each **20c**

JACKS

JK 26.....each **20c**

CARBON MIKE

T-17-B Carbon mike.....each **$1.49**

VEEDER-ROOT METER and CASE

Counts number of feet of trailing wire antennae; number turns when winding on coil applicable for many uses; flexible shaft can be attached and connected to another device for counting without direct attachment; speed 300 ft. per minute for reeling out; beautiful bakelite case, jeweled dialite, pilot light enclosed 3 position switch, counts up to 1000
Each..... **95c**

All shipments F.O.B. Chicago. 20% deposit required on all orders.

Dept. C

ARROW SALES, INC.

59 WEST HUBBARD STREET • CHICAGO 10, ILLINOIS

Telephone: SUPERIOR 5575

7.558, is often heard well in Sweden around 5-6 p.m. (Skoog)

Celebes—Radio Makassar is now back on 9.265; is heard some mornings here in West Virginia with fair to good signals around 7:30-8:15 a.m.; man reads *English* news at 8 a.m. on Mondays, Wednesdays, Fridays. Has both man and woman announcers. Probably runs to around 9:30 a.m.

Ceylon—Radio SEAC, 15.12, is again heard with good signal to 12 noon closedown; apparently 11.77 has been dropped. The 15.12 frequency is also again used in the special beam to Britain on Sundays, 1:30-3:30 p.m.; *some U.S. DXers may have mistaken this one for the BBC due to fine quality and high level;* 7.185 parallels.

On West Coast is also heard on 6.075, mornings. (Balbi)

The 21.470 frequency is being used occasionally for special relays; was heard in January carrying the Australia-England Test Cricket Matches, around 2-3:30 a.m. (Radio Australia)

Radio SEAC is still requesting reception reports; verifies promptly by airmail card.

China—XGOY, 6.143, Chungking, is heard in Sweden closing down at 10:35 a.m. (Sellstrom) Reception of this frequency is erratic in Eastern U.S., but usually is readable at 7 a.m. when a woman reads news in *English.*

XGOA, Chungking, has been heard on West Coast mornings lately on old frequency of about 5.918; sign-off varies, some days before 9 a.m., and some days has been heard relaying XGOY's *English* news at 9 a.m. (Dilg) Here in West Virginia, I have been hearing a Chinese station on XGOA's 9.72 channel, with Chinese news at 8 a.m., and with the XGOY *English* news at 9 a.m.; positive identification has not been made, but I am reasonably sure this is XGOA. Some West Coast monitors report XGOA on 9.72 around 11 a.m. Swedes list the 5.917 frequency as used, 7-11 a.m.

XGOW, 6.051, Hankow, is heard in Sweden, 9-9:45 a.m. (Sonnegard)

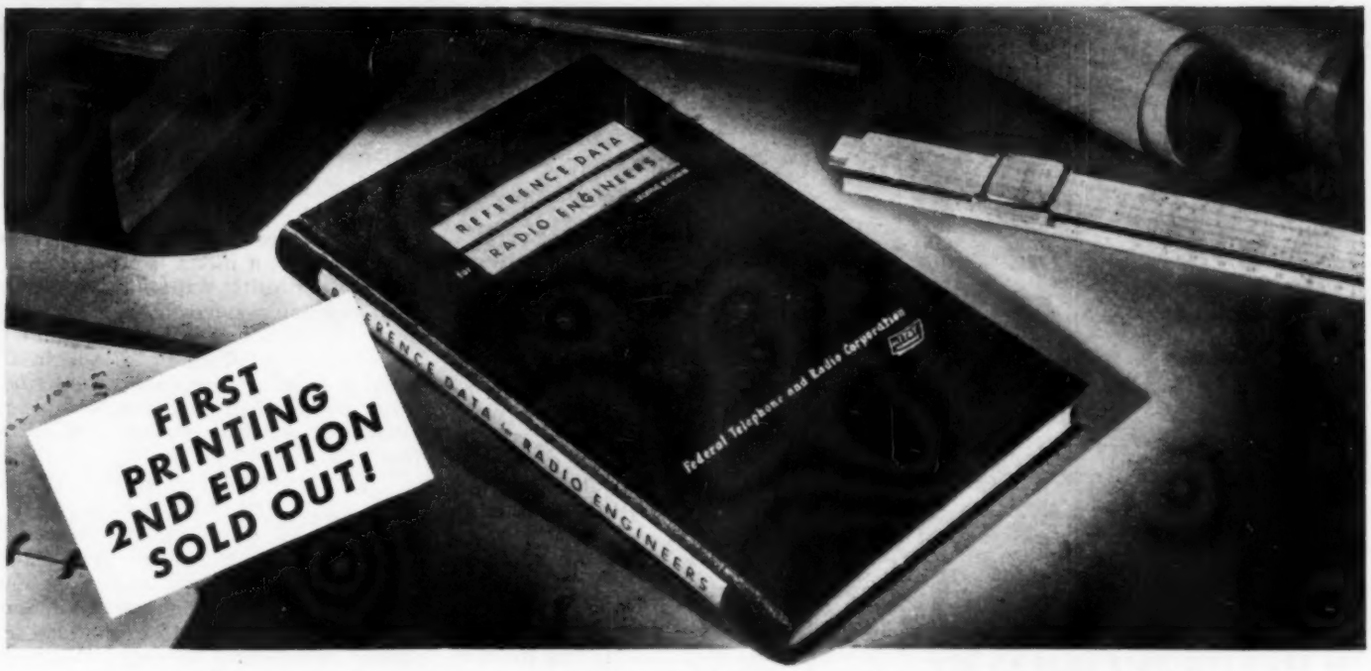
XTPA, 11.65, Canton, is using only 500 watts according to a verification received in New Zealand. (Cushen) Is heard well some mornings here in the Eastern U.S., mostly in Chinese, but does relay XGOY's *English* news

(*Continued on page* 156)

COMMUNICATIONS SQUADRON

BRIG. Gen. Frank Allen, Commanding General of the 56th Fighter Wing, Illinois Air National Guard, announces that he has been authorized to organize the 106th AAF Communications Squadron. Former World War II officers and enlisted men are eligible for membership and may be appointed in the National Guard at their wartime ranks.

Any male citizen between the ages of 18 and 35 may also apply for membership in the Guard. The Squadron will be located in the Chicago area. For further information write the Commanding General, 56th Fighter Wing, 5400 West 63rd Street, Chicago, Illinois or phone Portsmouth 9262. —30—



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LETTERS *from our readers*

HAM CORRESPONDENT WANTED

"I AM writing to tell you that we English-speaking radio amateurs in Europe love and read RADIO NEWS just as much as all hams in America. I can say that I have increased my knowledge of radio enormously since I started reading your magazine two years ago. I especially like articles dealing with the construction of ham gear, test equipment, etc. and I hope that you will include them in all future issues.

"Regarding the article on cathode follower output stages in audio amplifiers by Mr. Craig Stevens, published in the August issue, you reproduced in the November issue a letter by Reader Richard Gaines which informs us of the existence of the 6A5-G tube. The base diagram in the ARRL Handbook however shows an internal connection between heater and cathode, which fact obviously makes this tube no more useful in this particular application than the 6A3. Besides, I believe that the manufacture of this tube has been discontinued and Mr. Stevens was therefore completely justified in hoping that a heater-cathode type triode would soon appear on the market.

"On this occasion I should like to send greetings to RADIO NEWS and to all its readers and I should be very glad if any American ham would like to correspond with me and exchange ideas about radio. 73."

George H. Djordjevich
Ayaz Pasa, Gumus Suyu Cad.
Lambropulo Apt. 3
Istanbul, Turkey

Our thanks to Reader Djordjevich for his comments. If any of our amateur readers would like to correspond with him, address your letters to the above address.

* * *

PROFITABLE SERVICE FIELD

"PERHAPS the following, which appeared in the *Richmond Times-Dispatch* in a feature article dealing with juke boxes, may be of interest to your readers.

" 'It is estimated that only 2 percent of the 5000 automatic phonographs used in dining and dancing establishments in Virginia are properly installed for good listening. Others have inadequate speakers or poorly adjusted equipment, giving the juke box a bad reputation because it seems to emit sounds reminding listeners of an iron foundry at work.'

"Doubtless the situation is as bad in other states. Although many juke boxes are serviced by the chain which controls them, there are many opportunities for profitable servicing in the juke box field. Sometimes one may gain a concession from a chain operator to service the boxes on his route. Such work can mean a steady source of extra profits without interfering with regular service work.

Lewis F. Garber
Blacksburg, Virginia

This is a good suggestion and alert servicemen might investigate the possibility of increasing their incomes in this way.

* * *

THE V.T.V.M.

"I BUILT the v.t.v.m. described by Lt. N. M. Smith in the July issue of RADIO NEWS and I believe one of my findings might save someone considerable time. After I had chosen proper resistances to make the plate voltage of V_1 and V_2 exactly 30 volts and the cathode 4.5 volts, I found the cathodes of the meter protector tube V_4 to be 2 volts positive. R_{26} had to be increased in value until that voltage was slightly more than 3 volts, then the v.t.v.m. was perfect.

"This variation was undoubtedly due to different sized power transformer used."

P. B. Pendery
Kansas City, Missouri

Thanks to Mr. Pendery for passing along this tip. Those of our readers who are building this equipment may wish to make this change.

* * *

SHANGHAI REPORTS

"WHEN reading 'Letters from Our Readers' in your November issue, I should also express my warm hope, as Mr. Edward A. Boguz did, that you will be able to have a series of booklets published later covering previously printed articles on different general topics as he suggested.

"However, I am always astonished and annoyed to see you break an article into several pieces and print them not on consecutive pages. I think you must have some sound reasons, but I am ignorant to see any significant advantages warranting it other than the convenience to you to insert advertisements at suitable intervals to attract readers' interest.

"Nevertheless, I would like to suggest some improvement that each article be better printed continuously on every other (odd number) page, and each article begin with a new page. On all even pages and in blanks on some odd pages left over by ends of printed articles, you may fill in with advertisements. In case the total number of pages for advertisements required is less than for articles, then you may have some articles printed on consecutive pages as an adjustment. By so doing, it will not only give much convenience to readers to follow each

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Magentronsil Type 2J32 (JAN.) just released. The 2J32 is designed for 10 cm. operation. Rated at 300 kw. peak pulse power. Complete information supplied. Listed at $200, our price $25.50. 2J38 Magnetron 3240 mc. complete with magnet. $37.50.

3J31's just received. One cm. magnetron listed at $95.00. OUR PRICE.....$20.00
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Duplexer using 1B24 3 cm..... 10.00
41-TR-1/724B ATR Tubes used in duplexers. Each..... 1.50
Magnets for magnetrons, each..... 12.00
715-B Pulse Power Tube..... 9.50
30 mc oscillator-amplifier with 2 6AC7's. Uses 723ab, Wave guide input, xtal detector. With 6AC7's 10.00
With 6AC7's and 723ab..... 16.50
Thermistor Beads (D-170396), for use with UHF and Micro-Wave Equipment (List $3.00). In separate sealed containers..... .95

3 CM WAVE GUIDE SECTIONS

Silver Plated Directional Couplers with a 20DB drop with:
B. 15° bend in wave guide 15" $4.40
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D. 90° bend in wave guide 15" long also 90° bend in coupler..... 5.50

E. T. Section with choke terminations..... 5.00
F. 2½ foot silver plated with 180° bend (2" radius)..... 4.50
G. 150° bend with 90° twist 3½" radius with pressurizing nipple and coax coupler..... 3.95
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M. 10 cm. Wave guide 1 per ft. 16 ft. lengths..... 3.00
Send For List.

NEW POWER SUPPLY for LM-18 freq. meter. Output: 290 v. @ 20 ma; 13 v @ 600 ma. Input: 105-125 v @ 60 cps; 260 ma; 27.6 W. type 84 rectifier tube; shock mounted. Complete with input and output plugs, tube included... **$14.75**

The DP-12 is a Navy direction finder, made by RCA with a frequency range of 100-1500 Kc. The input voltage is house current (115v/60c). The tube line-up is 3-6C6; 4-6D6; 2-76; 1-6AF6; 1-1523. This unit is equipped with loop output junction box, flexible transmission line, input transformer, deck bearings cable drums, operating pedestal, hand wheel, azimuth scale, loop antenna assembly, and loop pedestal. A Buy for Sea Going Vessels. Value $2500..... **$195**

RELAYS

A. SPDT leach 1353 115v/60 cps. coin silver contact 10 A. Rating. This relay is actually DPDT with a Bridge between the two poles. Easily converted to DPDT.....$1.59
B. SPST 5a. ac; 115v cont. 115v/60 cps.....$1.25
C. SPDT contacts, coil rated 115v/60..... 1.30
D. SPST Latching relay made by Kurman. Make coil 115v/60c; DCR 1500 ohms. Break coil 115vdc 10 ma; DCR 5000 ohms..... 2.95
E. DPST Telephone type; 2p, 1 cl; 1 open cont. rating 5a at 50v, coil rating 3.5 ma (at 12K ohms), 1000 vac..... 1.05
F. DPDT Steatite insulated 10 am silvered contacts, made by Leach..... 1.95
G. SPDT Struthers-Dunn sensitive keying relay. 5 MA-DC Coil, 110v/60 cycles—2 Amp. contacts..... 1.49

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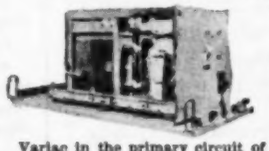
Ideal for detecting underwater sounds, such as fish swimming in schools, within a 15 mile area. Using a Rochelle salt crystal, which is about 1000 times more sensitive than quartz, as the active unit the sound is transmitted up a 60 ft. length of cable. It is completely enclosed in a solid rubber sheath. This sound detector was originally used in harbor defense. Coupled to an audio amplifier, this can be found to have many valuable applications. Ask for SD-1..... **$6.95**

RA-58-A HI-VOLTAGE POWER SUPPLY



Ideal for breakdown insulation testing, or as a source of power for a pulse transmitter. This unit supplies continuously variable voltage between 500 and 15,000 volts DC at 35 ma. A voltage Doubler circuit using two 705a rectifiers and two 1 mf condensers is employed. RMS ripple voltage at maximum power is 6%. THIS UNIT OPERATES FROM 115v/60c. Variable voltage is obtained by means of a Variac in the primary circuit of the high voltage transformer. Size is 21"x 17½"x29" deep. Net weight 314 lbs. This unit sells for the low price of **$116**

Army-Navy type headphones Type H823. Leather covered headband, detachable rubber cushions, lightweight headset with 2,000 ohm DCR. 8000 impedance, with 6 ft. cord and P1-55.
New in cartons..... $2.50
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Test Set EE65—Made by Conn. T & E Corp. $29.50

This unit is used for checking and maintaining field telephone systems by testing for all types of failures in the lines, such as opens, shorts, grounds, crosses with other lines capacity between lines, insulation resistance, and many of the other faults possible in a phone system.

CW-3 Relay Rack Receiver

This superhet receiver will operate on any fixed frequency from 1900 kc. to 16,500 kc. Uses 7 tubes. Operating frequency is determined by Xtal. With 2 coil groups 5.4 to 10 mc; 9.4 to 16.5 mc. available. Priced new with spare tubes and one set of coils (9.4 to 16 mc.) less Xtal..... $21.50
Coils for 5.6—10 Mc. Extra..... 3.00

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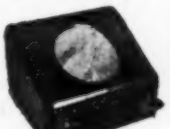

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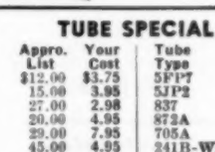
XTAL FILTER



I-F Crystal filter for BC-312, BC-342. Resonant at 470 kc. Crystal included. **$6.95**

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Tube Type	Appro. List	Your Cost	Tube Type	Appro. List	Your Cost
2AP1	$12.00	$3.75	5FP7	$32.00	$4.25
3BP1	15.00	3.95	5JP2	48.00	8.85
3FP7	27.00	2.98	837	2.80	1.35
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2 mf 300 vdc	.30	1 mf 1000 vdc	.85
4 mf 300 vdc	.35	2 mf 1000 vdc	.98
4 mf 400 vdc	.55	1 mf 1500 vdc	1.05
5-5 mf 400 vdc	1.15	.4 mf 1500 vdc	.30
2 mf 550 vdc	.30	2 mf 600 ac/1000 dc	.95
.25 mf 600 vdc	.25	4 mf 1500 vdc	1.30
.85 mf 600 vdc	.30	1 mf 2000 vdc	1.20
1 mf 600 vdc	.35	.1 mf 2500 vdc	1.20
2 mf 600 vdc	.40	**DRY ELECT. COND.**	
3 mf 600 vdc pyr	.65	500 mf 200 vdc	$1.95
4 mf 600 vdc pyr	.70	4000 mf 30 vdc	2.25
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article while doing no little harm to the attraction value of advertisements, but also render such articles of much more permanent reference value. At the same time, any reader can take out any article or articles as he likes and keep them in separate files, so that he can have separate booklets bound by himself later.

"Is it worthwhile or practical for you to make such changes?"

T. L. Tsang
Shanghai, China

Not at the moment, Mr. Tsang, but we will keep your suggestion in mind.

—30—

FM Modulator

(*Continued from page* 57)

be of either magnetic or nonmagnetic material, the headphone unit diaphragm, if replaced, will have to be of magnetic material. While conventional condenser microphones make use of very thin non-magnetic diaphragms which are designed to respond to sound waves, the headphone diaphragm must respond to a magnetic field only.

Remote Tuning

Another use which suggests itself for this unit is shown in Fig. 3. Here the unit is used for the remote tuning of any circuit by connecting the condenser section to the circuit to be tuned and applying a direct current to the headphone unit coils, then varying the d.c. with a rheostat at the distant post. This operation causes similar variations in the capacity section of the unit, and causes a change in the tuning of the circuit to which it is connected, thus remotely controlling its resonant frequency.

It should be noted that a frequency modulated signal can be received on any AM receiver providing the deviation of the transmitter frequency under modulation does not exceed the selectivity range of the receiver. The second detector in the receiver will act as a slope detector if the receiver is tuned to either side of the received carrier.

—30—

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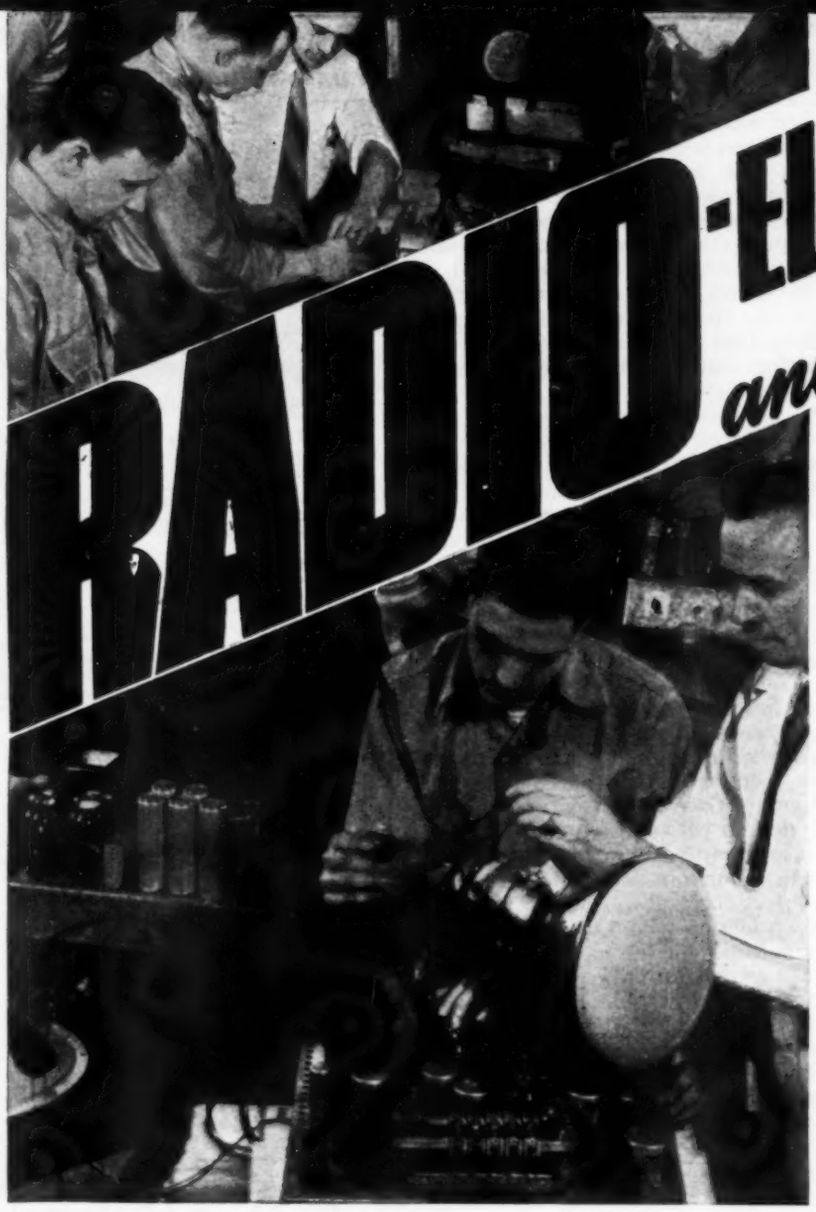

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Modern Divining Rod

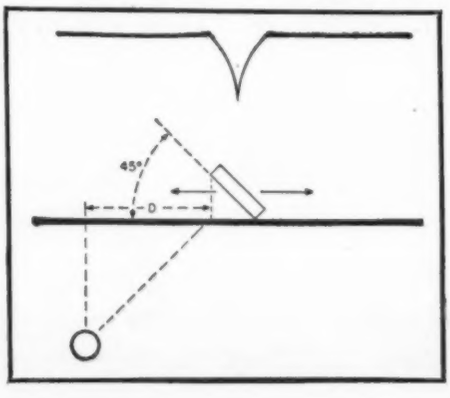
(*Continued from page* 43)

is clearly shown in Fig. 2. It should be quite apparent that the size (ignoring composition) of the article in relation to the size of the detection loop determines the detectability of any machine. Thus a small loop (whether bridge, beat frequency, or radio balance) will detect a small object much better than a large loop. Conversely, the small loop has a small flux field; therefore a large loop must be used for depth penetration, which will have no sensitivity for very small objects. It becomes apparent then that this machine is best suited for the location of small objects in the earth or walls of buildings. A small iron object may be detected at a greater depth than a small non-rusting object due to the effective increase of its distortion pattern by the iron rust spreading out through the soil surrounding the object.

The picture of the 520 seems to indicate a large detection loop. There is one large detection loop. A second very small loop is contained in the housing on top of the assembly. These two loops are positioned and formed so as to allow a null setting between them. The large loop is excited with a radio frequency oscillator and the small loop is used as the receiving antenna. Any signal in the receiving loop, caused by field distortion, is detected in a mixer tube with the use of a second radio frequency oscillator to produce an audible beat note capable of being amplified and fed to the headphones used with this unit. Further details of similar theory and operation may be found in the following discussion on the Model 599 pipe and object locator.

The previous model, just discussed, is not suitable for the location of pipes, unless they are quite large. The Model 599 while not suitable for the detection of objects as small as a penny, will detect pipes and large objects at great depth. This unit is constructed in three sections, the transmitter, the receiver, and the interconnecting wooden poles. This allows ease of transportation and several other modes of operation.

A built-in depth gauge on the receiver unit facilitates quick measurement of pipe depth.



A rather extended discussion is necessary to present the above modes of operation and to cover the numerous other factors bearing on the performance of radio balance instruments. Some of these are mentioned here without elaboration. The detecting depth of the apparatus varies with the size of the loop antennas employed. The larger the loops, the greater the detection depth, but the larger must be the object to ensure detection. Larger loops require longer spacing between them which permits the use of greater transmitter power, a condition also necessary for greater depth detection. Increased power as well as larger loops require greater spacing between the loops which, in turn, requires longer carrying handles. Longer handles present an additional problem, that of maintaining rigidity. A highly efficient radio balance cannot tolerate any appreciable deflection of the handles, as it is necessary to maintain the radiating and detector loops in a definite angular relationship to each other.

Any given instrument must be designed with the correct relationship between transmitter power and receiver sensitivity. If this is disregarded, an otherwise good instrument is almost worthless. As much transmitter power should be used as will allow a good null and high receiver gain. It must be remembered that frequencies suitable for one type of exploration are not necessarily suitable for other types.

Even though all of the considerations discussed herein have been fully taken into account, there is at least one other which would vitiate the advantages so painstakingly secured. This relates to the electrostatic capacity of the earth's surface, green vegetation and the body of the operator. Unless the apparatus has been designed so as to eliminate quite completely the unbalancing effects of extraneous electrostatic capacities, the apparatus is useless almost exactly in proportion to the amount of power or sensitivity employed. Several methods are available for eliminating this effect. The use of a Faraday shield, center tapped loop and/or the use of a proper *LC* ratio in the loop antennas affect the operation to a great extent.

Being so constructed electrically as to be free of the unbalancing effect of ground capacity, the instrument should be provided with a means of operating it close to the ground in order to gain the advantage of the additional detection depth available. This arrangement may be simply effected by the use of wire drop handles which can be snapped into place quickly or removed readily.

There are two more desirable features to have in a metal detector. These include the accurate tracing of the course of a metallic and *non-metallic pipe*. Secondly, it is desirable to be able to detect an object at a great distance and yet be able to localize it to within half of its diameter. The

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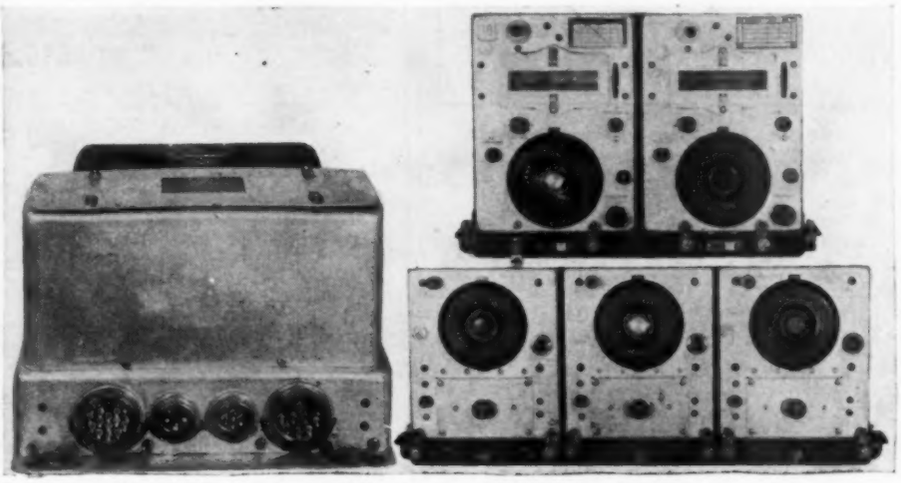


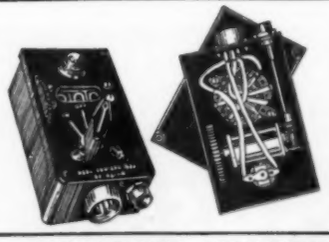
These components are practically new and have had Ferry time only.

This complete combination package consists of 3 receivers—the BC-453-A (190 to 550 kc) the BC-454-A (3.0 to 6.0 mc) and the BC-455-A (6.0 to 9.0 mc). These receivers operate from a 24-28 volt source and each contains a separate dynamotor for plate power. These receivers are very sensitive, incorporating an RF stage, BFO for c.w. reception and make excellent receivers up to approximately 10 mc.

The two transmitters, BC-457-A (4-5.3 mc) and BC-458-A (5.3 to 7 mc), consist of a master oscillator tube (16Z6 or 12J5) exciting a pair of beam tetrodes in the power amplifier stage (16Z5's or 12 volt 807's). The tubes in the amplifier are connected in parallel. Included in each transmitter is a Piezo-electric crystal and an electronic resonance indicator for calibration. The transmitters are complete with dynamotors.

The modulator (with dynamotor) contains all necessary circuits and components for plate and screen modulation of the transmitters.

All mounting racks, remote control boxes, jack boxes, and antenna relay box are included in this superlative offer.



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5.0 mfd., 150, 500 cycle	50c
5.0 mfd., 300	50c
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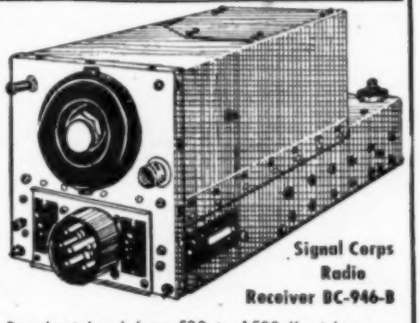

Signal Corps Radio Receiver BC-946-B

Broadcast band from 520 to 1500 Kc, tube complement: 3-12SK7, 1-12SR7, 1-12A6, 1-12K8; can be used with 24V dynamotor supplying A and B power; can be converted to AC or DC or 32 Volt sets; 3 stages of I.F. used. Uses 3 gang condenser. Complete with tubes and schematic $12.95

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.04—600V.	12c
.003—600V.	12c
.001—1000V.	20c
.01—1000V.	20c
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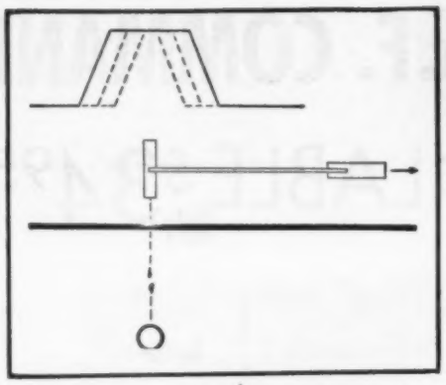

Maximum signal occurs when transmitter is directly above the buried object.

conventional instrument increases its output slowly to a peak when passing over a pipe. With full gain at the receiver, the *Goldak* causes the indicator to go off scale when at a great distance and to stay off scale until the detection range has been paced off. This reduces the hunting for a buried object. It is necessary once this location has been made, to find the exact spot of burial. By reducing the receiver gain to the point that only the signal directly over the object produces the output voltage necessary to kick the high mu biased trigger circuit, it is possible to get needle point accuracy of location.

When the location of a pipe is not known approximately, the assembled unit is used as an induction balance. When so arranged the transmitting loop is nulled to the receiving loop and the apparatus is carried over the ground. Whenever carried across a pipe or cable a sharp signal is given in both the headphones and on the meter. After securing a close fix as previously described, the unit is disassembled. If the transmitter is set parallel to the pipe and above it, the pipe will pick up the radiation carrying it in both directions and to all nearby branches. The simplest way is to set the transmitter upright on the ground directly above the pipe and as nearly as possible parallel to it. This places the hole in the loop at right angles to the pipe. Putting the receiver in the same position as the transmitter, over the pipe and at least 15 feet away, it will give a response. At this time the receiver gain is reduced until the signal is barely audible. Now if the receiver is swung slowly across the pipe from side to side, keeping it upright and parallel to the pipe, it will give a sharp maximum signal directly above the pipe, dropping to zero a short distance on both sides. The pipe may be followed thusly. This illustrates the basic process of locating and tracing pipes. By holding the receiver flatwise to the ground, and turning the response control up, it will be observed that a dead null results when the middle of the receiver is directly over the pipe. This illustrates the basic process of centering, and by this means, a pipe or cable can be centered to within a space not

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RCA modulation transformer is conservatively rated at 350 Watt audio to modulate that new KW rig.
Really rugged construction with protective flashover gaps, which are adjustable. Terminals and gaps are mounted on a "Mycalex" terminal board. The laminations that make up this transformer are of high audio quality and are extremely thin, making it impossible for the core to "chatter or talk."
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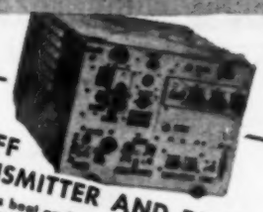
Impedance Ratio—Pri: #1-1:1 Sec. Pri: Sec. #2-25:1 Pri: Sec. #2 Tap—625:1.
DC Resistance—Pri: 135 ohms Sec: #1, 112 ohms; Sec. #2, 99 ohms.
Transformers insulation tested: Pri. 8000V.; Sec. #1-11-000V; Sec. #2-2000V. to the rest of the coils and core. Primary center-tapped for Class "B" modulators. Secondary #2 will carry 80 Mils to modulate screens of beam power or screen grid tubes. Primary will match any Class "B" tubes up to 10,000 ohms plate to plate, such as 810's, 75T's, 805's, ZB120's, 203's, HY51Z's, 211's, 813's, 828's, 805's, 203Z's. Size 9½" wide, 7½" deep, 7¼" high. Heavy channel iron mounting brackets. Weight approx. 40 lbs. Catalog number MT-100.



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The famous boat anchor released from Government surplus, has been widely used on the 144 MC band. It can now be used as a transmitter and receiver. Shipping weight 100 lbs. Your price, less tubes and power transformer. Catalog number RT-102..... **$14.95**

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Cat. No.	Cap. MFD.	Working Volts	Your Cost
C110	1	5000 Oil	$3.95
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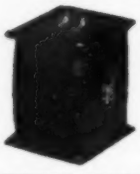

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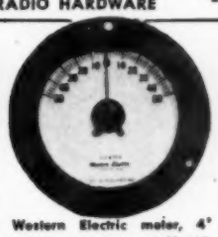

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2,000 ohm	25,000 ohm	70,000 ohm
3,300 ohm	30,000 ohm	75,000 ohm
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18,000 ohm	65,000 ohm	600,000 ohm

±1W **39c ea.** 3 for **$1.00**

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Ideal for high frequency work.

Type A—frequency range 76 to 300 megacycles to be used with 955 tubes. Cat. No. BC-1.

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Used as liaison transmitter in bombers and ground stations. Frequency range of 200-500 Kc. and 1,500-12,500 Kc. is covered by means of 7 plug-in tuning units furnished. By slight modification operation on 10 and 20 meters is possible. Oscillator is self-excited temperature compensated type. Power amp. is neutralized class "C" using 211 tube and is equipped with antenna coupling circuit to match practically any antenna. Modulator is class "B" using two 211 tubes. Power supply is 24 V. DC dynamotor which furnishes 1,000 V. at 350 M. A. However, transformer is ideal for construction of 110 V. AC power supply. Transmitter output conservatively rated at 42.5 watts, phone 75 watts CW, but may be pushed to 150 watts. Complete with tubes, dynamotor, seven tuning units, and cable connector plugs. Brand new..... **$49.95**

R44/ARR-5 HIGH FREQUENCY

receiver. Patterned after S-36A by Hallicrafters. Receives FM and AM signals in the spectrum between 28 and 145 megacycles. Circuit has 14 tubes including voltage regulator for high frequency oscillator. Has two position selectivity control. Contains no internal power supply. Has acorn tubes RF., Osc., and Mixer. Complete with components for power supply including transformer, choke, filter condensers, and rectifier tube..... **$100.00**

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wider than the diameter of the pipe itself.

When it is desirable to trace closely spaced pipes or non-metallic pipes, another innovation is required. Here the pipe is energized by direct connection from the radio frequency oscillator. With the pipe energized as above, the usual operations of tracing, centering and depth measurement can be performed in the regular manner. It is necessary that a special shielded oscillator unit be provided so that there will be no energization from the loop. In the pipe locating model, this is a built-in feature. A terra cotta, cement and other non-metallic pipe can be worked by first running a metallic tape or wire into it from some accessible point. When the tape is energized, the pipe can be worked by any of the regular methods. This is especially valuable in the case of sewer stoppage. To locate the point of stoppage, simply feed the tape into the line until the block is reached. The stoppage is, of course, located by tracing the energized tape to the end.

When an energized pipe is traced to a dead end, the signal does not cease abruptly exactly at the end. As in the case of tracing a tape in a non-metallic line, it continues beyond the actual end by an amount roughly equal to the depth of the pipe. The amount by which it overruns the end depends upon how high the transmitter power is operated.

Energized pipes not only carry the currents induced by the transmitter, but the earth around them also carries much of these same currents. Around straight-away pipes and cables, the current patterns are quite symmetrical and the operations of tracing, centering, etc., can be done sharply and accurately. At such places however, as T's, L's and dead ends, the current patterns are irregular and complex and give correspondingly complex and indefinite reaction to the receiver. Around such points there exists an area of confusion which makes it difficult, if not impossible, to work a T, for example, right up to the actual point of intersection of the pipes.

Summarizing, electronic induction balance instruments are of definite use in the commercial field. The departments of power, gas and water of numerous cities use these machines for the location of pipes for repair work. Where ditching machine operations are required, such a machine is a necessity. The line of the cut is first surveyed and the machine operated along the survey. By this means every pipe or cable crossing the course of the trench can be spotted definitely and its location marked. The operator of the ditching machine can then cut to within a safe distance of the cross pipe and avoid a dangerous or costly accident. There are other commercial uses too numerous to number.

—30—

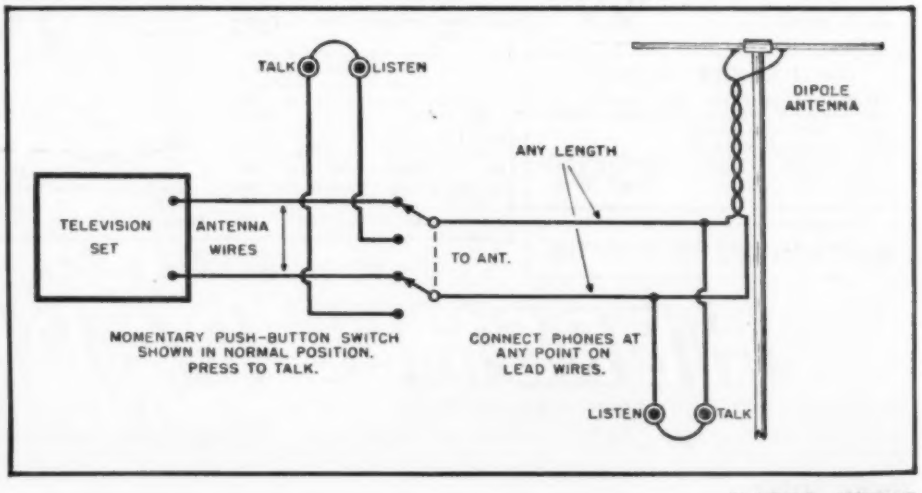
TELEVISION ANTENNA INSTALLATION

By SAM RUBIN

A VERY simple method for television antenna installation combines ease, portability, no extra wires and no batteries. All that is necessary for the installer is a push button, double pole, double throw switch and two pairs of earphones. The antenna itself is used as the line for communicating from the room where the television receiver is located, to the roof. Conversation comes through loud and clear.

The d.p.d.t. switch in the normal position connects the antenna to the receiver for normal operation, enabling the operator at the set to view the signal. By merely depressing the push button switch, two way communication is established between the man below and the man on the roof. In this way, the antenna may be oriented for the strongest signal and for the elimination of ghosts and double images with a minimum of time, effort and equipment. The serviceman on the roof may have his hands free for work on the antenna by using a breastplate for the phone he talks through. The high impedance of the phones does not affect the operation of the low impedance antenna lines. —30—

Diagram shows how two-way communication can be achieved without elaborate equipment.



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Radio (and its allied fields—electronics, television, radar) now looms as a major industry in the United States offering a constant and ever-expanding field of wealth and opportunities. Each new development points the way toward further improvements and an increasing demand for men and women, specialized in this field.

The Radio courses offered by the Tyler Commercial College are highly specialized to enable you to enter many branches of radio, both as your vocation or your profession. The present courses listed represent a partial list of the extensive and complete training offered by the Tyler Commercial College who have had over 30 years experience in the Radio Training Field.

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GENERAL RADIO COURSE

The course in General Radio is designed to provide a broad foundation for careers in the technical radio field. Among the various job objectives are Radiotelephone Operator (broadcast, police, or airline), Radiotelegraph Operator (marine, zone police, or airline), and Radio-Electronics Technician (industry). Success in qualifying for F.C.C. Radiotelephone or Radiotelegraph License is a requirement for graduation; therefore, an extensive study of radio theory, essential radio mathematics, and laws and regulations governing radio communications is included in preparation for operator license examinations.

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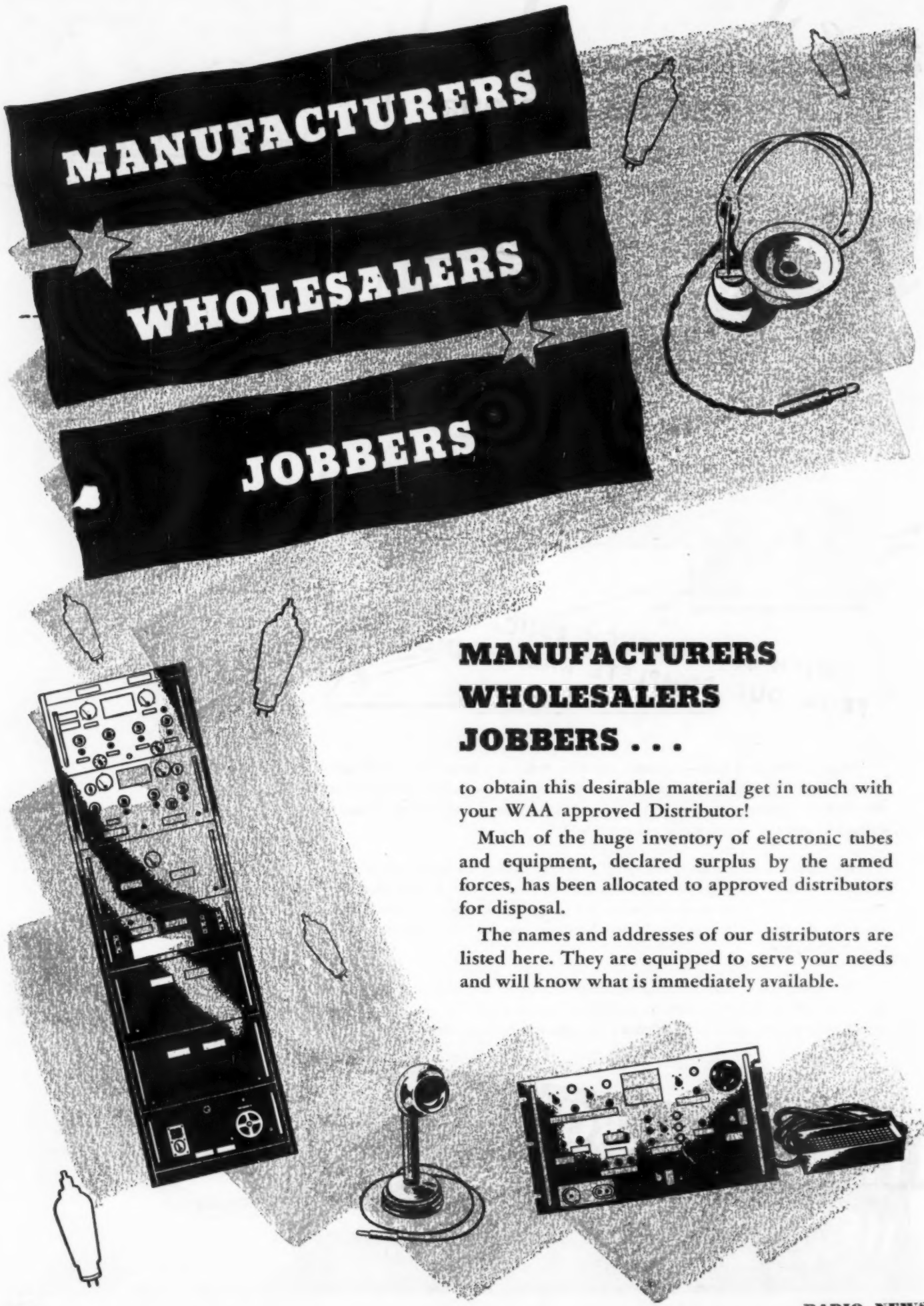

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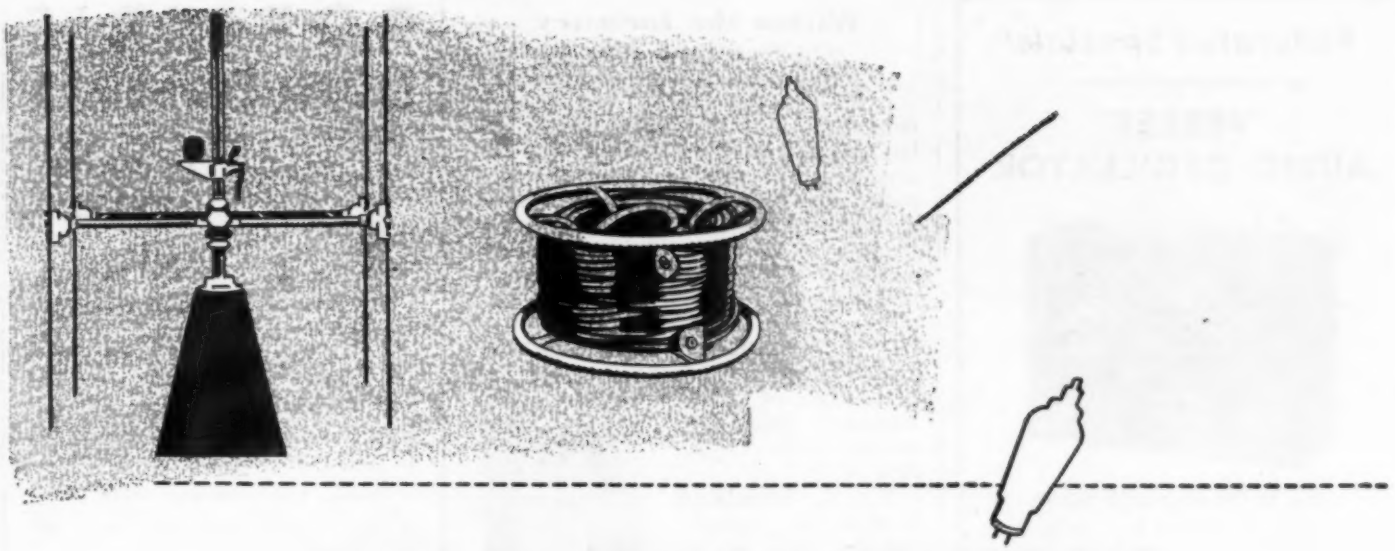
to obtain this desirable material get in touch with your WAA approved Distributor!

Much of the huge inventory of electronic tubes and equipment, declared surplus by the armed forces, has been allocated to approved distributors for disposal.

The names and addresses of our distributors are listed here. They are equipped to serve your needs and will know what is immediately available.



THESE ARE THE APPROVED DISTRIBUTORS APPOINTED BY THE WAR ASSETS ADMINISTRATION TO SERVE YOU:

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4410 Ravenswood Avenue
Chicago 11, Illinois

Automatic Radio Mfg. Co., Inc.
122 Brookline Avenue
Boston 15, Massachusetts

Belmont Radio Corporation
3633 So. Racine Avenue
Chicago 9, Illinois

Communication Measurements Laboratory
120 Greenwich Street
New York 6, New York

Cole Instrument Co.
1320 So. Grand Ave.
Los Angeles, California

Electronic Corporation of America
353 West 48th Street
New York 19, New York

Electro-Voice, Inc.
Carroll & Cecil Streets
Buchanan, Michigan

Emerson Radio & Phonograph Corporation
76 Ninth Avenue
New York 11, New York

Essex Wire Corporation
1601 Wall Street
Ft. Wayne 6, Indiana

General Electric Company
Building 267-1 River Road
Schenectady 5, New York

Raytheon Manufacturing Company
60 East 42nd Street
New York 17, N. Y.

Smith-Meeker Engineering Company
125 Barclay Street
New York 7, New York

Southern Electronic Company
512 St. Charles Street
New Orleans 12, Louisiana

Standard Arcturus Corporation
99 Sussex Avenue
Newark, New Jersey

Sylvania Electric Products, Inc
Emporium, Pennsylvania

Technical Apparatus Company
165 Washington Street
Boston 8, Massachusetts

Tobe Deutschmann Corporation
863 Washington Street
Canton, Massachusetts

Tung-Sol Lamp Works, Inc.
95 Eighth Avenue
Newark 4, New Jersey

General Electronics Inc.
1819 Broadway
New York 23, New York

Hammarlund Mfg. Company, Inc.
460 West 34th Street
New York 1, New York

Hoffman Radio Corporation
3761 South Hill Street
Los Angeles 7, California

Hytron Radio & Electronics Corporation
76 LaFayette Street
Salem, Massachusetts

E. F. Johnson Company
206 Second Avenue, S. W.
Waseca, Minnesota

Majestic Radio & Television Corporation
125 West Ohio Street
Chicago 10, Illinois

National Union Radio Corporation
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1000

Within the Industry

(*Continued from page 32*)

committee is to coordinate the activities of associated industries with the progress of television. The affiliated industries include telephone, motion picture and film manufacturing, antenna designers and manufacturers, and apartment house owners and operators.

* * *

THE K. W. STREUBER ORGANIZATION has been appointed to head the export division of the *Eastern Amplifier Corp.*, New York City.

Mr. K. Streuber, head of the organization, has been connected with theatre and sound equipment export for the past fifteen years. By this move, *Eastern* hopes to expedite foreign trade and develop the business possibilities for sound reinforcing equipment in the foreign market.

* * *

VINCENT BARRECA, for twelve years an officer of *Admiral Corporation,* has been appointed managing director of *Canadian Admiral Corp., Ltd.*

Mr. Barreca was employed by *Admiral's* predecessor, *Continental Radio & Television Co.,* at the time of its organization and since has served in practically every department of the corporation.

At *Admiral's* newly-formed subsidiary, he will be in charge of producing and merchandising the company's radios and refrigerators throughout Canada. Headquarters will be at 8 Colborne St., Toronto.

* * *

GRANT SHAFFER has been named Michigan sales representative for the *Jensen Manufacturing Co.* of Chicago, manufacturers of acoustic equipment.

A graduate electrical engineer of Armour Institute of Technology, Mr. Shaffer was formerly employed by the *Underwriters' Laboratories, Jefferson Electric Co.,* and *Standard Transformer Corp.* He began his career as a sales representative by selling *Stancor* and other electronic lines in the Michigan territory.

* * *

THE HALLICRAFTERS COMPANY recently moved into their newly-constructed $600,000 plant at 4401 W. Fifth ave., Chicago. The building, designed to increase production by combining their former nine plants and offices into one location, has six double production lines with the capacity to build twelve models simultaneously. The production line schedule will enable raw material to be brought in and

Now Available for Immediate Delivery!

THE NEW MODEL 670

SUPER-METER

A Combination

VOLT-OHM MILLIAMMETER plus CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

Added Feature:

The Model 670 includes a special GOOD-BAD scale for checking the quality of electrolytic condensers at a test potential of 150 Volts.

Specifications:

D.C. Volts: 0 to 7.5/15/75/150/750/1,500/7,500 Volts

A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts

OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts

D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5 Amperes

RESISTANCE: 0 to 500/100,000 ohms; 0 to 10 Megohms

CAPACITY: .001 to .2 Mfd. .1 to 4 Mfd. (Quality test for electrolytics)

REACTANCE: 700 to 27,000 Ohms; 13,000 Ohms to 3 Megohms

INDUCTANCE: 1.75 to 70 Henries; 35 to 8,000 Henries

DECIBELS: —10 to +18 +10 to +38 +30 to +58

The Model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½"x7½"x3".

$28.40 NET

PLEASE PLACE YOUR ORDER WITH YOUR REGULAR RADIO PARTS JOBBER. IF YOUR LOCAL JOBBER CANNOT SUPPLY YOU, KINDLY WRITE FOR A LIST OF JOBBERS IN YOUR STATE WHO DO DISTRIBUTE OUR INSTRUMENTS OR SEND YOUR ORDER DIRECTLY TO US.

SUPERIOR INSTRUMENTS CO.

Dept. RN 227 FULTON ST., NEW YORK 7, N. Y.

finished models shipped out in one continuous process. The plant, which covers 141,000 square feet, has a cafeteria large enough to accommodate 300 of the 1200 employees at once.

* * * *

CLAROSTAT MANUFACTURING COMPANY, INC., Brooklyn has announced the appointment of I. J. Youngblood to the position of vice-president in charge of sales.

After his graduation from Drexel Institute of Technology, Mr. Youngblood served in the U. S. Navy during the first war on the supervision of radio compass and underwater detection activities. His former positions include production supervisor and head of the component parts engineering department at *Philco* and a member of the engineering staff at *Farnsworth*. He joined *Clarostat* seven years ago as sales engineer and since has mounted to his present position.

* * *

DANIEL E. NOBLE, general manager of the Communications and Electronics Division of *Motorola*, has been named vice-president in charge of that division.

He has been associated with *Motorola* since 1940, at which time he became Director of Research. For the past six years Mr. Noble has been engaged in the development of FM communications equipment for mobile service and military applications.

Mr. Noble is chairman of Panel 13 of the Radio Technical Planning Board, chairman of the RMA Emergency Service Equipment Committee and chairman of the IRE committee on railroad and vehicular services.

* * *

NATHAN HELLMAN has been appointed Chief Engineer in charge of research and development of *Tradio, Inc.* in Asbury Park, N. J.

Mr. Hellman, formerly of *Ansley Radio*, where he worked on intercommunication and radar sets for the Navy, has eighteen years' of experience in the industry. Prominent in his list of accomplishments is an electronic piano using the FM principle and *Tradiola*, the coin-operated restaurant radio.

* * *

RUSSELL B. RENNAKER, formerly of the O.S.S., has joined the *Collins Radio Co.*, Cedar Rapids, Iowa as head of the Broadcast Sales Division. Past National President of the Association of Broadcast Technicians, Mr. Rennaker has also been associated with *Federal Telephone and Radio Corporation* and was a CBS. engineer supervisor.

The appointment of Robert H. Hollister as his assistant was announced at the same time. A civilian employee for the office of the Inspector of Naval Materiel, Mr. Hollister served as chief inspector at *Collins* during the war. At its climax he joined the *Collins* organization in the Broadcast Sales Division.

—30—

HARDIN COLLEGE USES RADIO NEWS SIGNAL TRACERS

FROM James H. Sligar, Director of the Hardin College School of Radio and Electronics (Wichita Falls, Texas), comes word that signal tracers like the one described in the January, 1946, issue of Radio News are being constructed and used by Hardin students enrolled in the course on radio servicing.

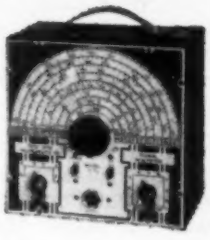
To date almost two hundred of these instruments have been built by the students who, upon completion of their academic and laboratory work, are permitted to take these signal tracers and other home-built test equipment with them when they start their professional work in the field. —30—

ALL ITEMS LISTED BELOW NOW AVAILABLE FOR IMMEDIATE DELIVERY *from* STOCK

General Electronic DISTRIBUTING COMPANY
THE NATION'S HEADQUARTERS FOR TEST EQUIPMENT!

Our Policy: All units are sold subject to one year guarantee except when components are damaged through misuse. We do not solicit orders for any unit that does not meet our requirements for accuracy and honest value. Any item purchased from us is sold with the understanding that it may be returned for *full refund* after a 10 day trial.

The New Model B-45 SIGNAL GENERATOR



Self-modulated—provides a highly stable signal. RF frequencies from 150 Kc. to 12.5 Mc. on Fundamentals and from 11 Mc. to 50 Mc. on Harmonics. Modulation is accomplished by grid-blocking action—equally effective for alignment of amplitude and frequency modulation as well as for television receivers. Self-contained batteries. All calibrations are etched on the front panel. **Complete, ready to operate.** **$27.75**

The New Model 450 TUBE TESTER

SPEEDY OPERATION assured by newly designed rotary selector switch which replaces the usual snap, toggle, or lever action switches.

Specifications:

- Tests all tubes up to 117 Volts.
- Tests shorts and leakages up to 3 Megohms in all tubes.
- Tests individual sections in multi-purpose tubes.
- New type line voltage adjuster.
- Noise Test: Tip jacks on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.
- Works on 90 to 125 Volts 60 Cycles A.C. Complete with all operating instructions.

$39.50

The New Model 670 SUPER METER

A Combination VOLT-OHM MILLIAMMETER plus CAPACITY REACTANCE INDUCTANCE and DECIBEL MEASUREMENTS.

Added Feature:

The Model 670 includes a special GOOD-BAD scale for checking the quality of electrolytic condensers at a test potential of 150 Volts. **Complete with test leads and operating instructions.** **$28.40**

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Olson Gives You a Big, Authoritative Book on How to Operate a Radio Shop Successfully

200 pages of practical advice and information, to help you make a go of your Radio and Appliance Shop. This book was recently prepared by recognized authorities in co-operation with the Radio Manufacturers Association. If you are in business for yourself, or planning to open a shop or store, YOU NEED THIS VALUABLE BOOK.

CONTENTS: Business For Yourself — Selecting a Location — Building, Equipment, Layout—Financing, Legal Organization, Regulation — Buying — Sources of Supply — Receiving and Stocking — Retail Salesmanship — Advertising and Sales Promotion — Window and Interior Display — Repair Services — Major Appliance Sales — Traffic Appliance Sales — The Farm Market — Personnel — Record Keeping — Credit Management and Expense Control — Development and Growth.

HOW TO GET IT: We will send you a FREE COPY of this book with each order for $10 or more, during the next 30 days. Your order must be written on one of our official order blanks, which is sent with our FREE Confidential 48-Page Radio Repairman's Price Guide. Just mail the coupon!

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Please send me Official Order Blank and Confidential Radio Repairman's Price Guide. No charge, of course.

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Locating Your New Store

(*Continued from page 65*)

the buying. And a radio and appliance establishment, standing out by sheer contrast in a concentration of women's apparel shops, would have no inconsiderable sales possibilities.

Real estate experts gauge location values by starting with what is known as "100 per-cent location" or "100 per-cent section." The evaluation of merchandising sites is then graded down from that basis. A 100 per-cent section means simply the best possible retail section in any given community. But contained within the definition is a differentiation by type of business. In other words, the question of 100 per-cent location is not only one of situation, but also of the kind of merchandise that is sold by the store. A highly transient zone may be a 100 per-cent section generally but not specifically for merchandise intended for home installation and use. Times Square, in New York, is an example. Eating establishments, apparel stores, souvenir stores belong there. A radio and appliance store does not. And there is none.

There is, of course, a 100 per-cent location for a radio and appliance store. But that location will be one that serves a local or residential community. The community may be a town with a surrounding rural area, like Poughkeepsie, N.Y., or a home locality in a large city, like Flatbush in New York City's borough of Brooklyn. In Poughkeepsie,—and this observation holds true for hundreds of towns throughout the country,—the 100 per-cent retail section is Main Street running up and down from Market Street, the junction of these two arteries being the focal point of the retail section. But at the same time that Main Street a few blocks either side of Market is the 100 per-cent section for stores generally, it is also the 100 per-cent section for radio and appliance stores specifically. The reason for that is that this retailing area serves the surrounding community, both urban and rural, with all types of merchandise, including those for home installation and use. In the same way, local communities within large cities have retail sections which are 100 per-cent for those communities and these, like the Main Streets of small cities and towns, are 100 per-cent sections not merely for merchandising in general, but for sales of merchandise for home installation and use as well.

The 100 per-cent retail section in any given small town or local community tends to be concentrated in from one to three blocks along the main artery. At both ends of this section there is a tapering off of location value. At various points off the 100 per-cent section running into the side streets, there are also very often retail stores. These may run from a hundred to several hundred feet down

the side street or, in the case of an auxiliary artery crossing the main street, they may run along for a block or two. It is at the end of the 100 per-cent section and on the side streets immediately off it that the small radio and appliance dealer may be able to find a store of the type that he needs and that is within range of his finances. The question of the comparative merchandising value of the end-of-the-artery location as against the off-the-artery location can be answered only by local conditions.

The subject of 100 per-cent location has been discussed here not because the radio and appliance dealer of limited means is expected to achieve such a location, for except under unusual circumstances, it is not likely. The 100 per-cent location has been brought into the picture to provide him with the same basis for gaging location values that is used by the experts of the store location services. The 100 per-cent location constitutes an ideal on which the small dealer should keep his eyes even if he cannot attain the goal. He should try to get as close to this ideal as he can within the limits of his financial means.

In any retail center, from the 100 per-cent section down to the fairly good, the determining factor in the rental figure is frontage, that is, the footage width of store front. In fact, the real estate business itself always talks about stores in terms of dollars-per-front-foot. The value per front-foot is itself determined by the value of the location. The area of the store space is a secondary consideration in these calculations, although it comes into play. For instance, in any good retailing section, a 15′ x 40′ store (15′ being the frontage) commands a higher rental than an 11′ x 100′ store in the same section. The significance of frontage should not be forgotten in any contemplation of store location, for it is a long established fact that frontage, especially when the retailer utilizes his window space to its full selling potentialities, is one of the strongest of merchandising factors. The radio and appliance dealer would do well to sacrifice floor space to store frontage, as far as the size of his inventory will permit. For the sake of frontage, even inventory should be modified, if possible. Still, there are limits. For a radio and appliance establishment, 13 to 14 feet of frontage would normally be considered the minimum. In the same way, there is a minimum below which he should not go in the size of his inventory. If he handles heavy-duty equipment, like ranges and refrigerators, in addition to light-duty merchandise like toasters, and if he sells console-size radios as well as table and other small models, his floor display requirements may be such that he must content himself with small frontage in order to gain depth and area. But that does not alter the principle; where possible, modify floor space needs in favor of frontage.

It is not at all unusual to find that, in any retail center, one side of the street is better than the other. What makes it better, among other things, is the fact that it gets more pedestrian traffic or that it has a greater concentration of the types of stores in which more people do their shopping. The better side of the street invariably commands higher rentals. For the radio and appliance dealer, the higher rental may or may not be justified. If it happens for instance, that there is a concentration of housewares stores on the less active side of the street, with little or no competing radio and appliance business, that side might very well be better for his purpose, at the same time saving him rent. If, on the other hand, there is already a radio and appliance store on the less active side, the higher rental on the better side might very well be justified.

In making evaluations of locations and in providing data from which his clients make decisions, the store location expert adopts certain procedures, which are outlined here. Nobody can expect the individual prospective radio and appliance dealer who is out to spot a location of his own to adopt exactly the same procedures, but what he can adopt and what he can keep in mind are the principles of those procedures. He has much to gain in his own search for and decision on a location by coming as close as he can, with his limited personal facilities, to the information a store location service secures for its clients about any location under consideration. In any event, it is well worth his while to take a glance at how a store leasing expert goes about his business of compiling the background data needed for spotting and evaluating a prospective location.

1. A compilation of the history of the retail section under consideration, including information to date on ownership, rentals, lease expirations, zoning restrictions and other pertinent data on all properties in the area. With this as a basis, the individual site under consideration is then given attention as follows:

2. Complete details of the physical layout of the store as a basis for judging its suitability, its advantages and its disadvantages for the particular business involved.

3. Pedestrian traffic surveys which include (a) exact counts of passersby at that spot, (b) checks on buyers and strollers in that retail section, (c) the source and destination of traffic.

4. Studies of the retailing methods prevailing in the area.

Now, all this looks formidable and, in a sense, it is. And yet, in his own small way, the prospective radio and appliance dealer can go a considerable distance in the same direction.

First consider point No. 1. For a store location expert, this entails a rather extensive piece of research and the individual small dealer can not very well accomplish that. But there

are things he can do. He can drop in at the various shops in the section (avoiding stores which handle merchandise with which his will be in competition), say frankly that he is contemplating opening a radio and appliance store in the area and ask questions. If they are well chosen questions, designed to provide him with the type of information that will give him an over-all view of what has been happening in the area, he will receive enough pertinent answers to provide him with a reasonably good background.

Now look at point No. 2, the store's layout. In this instance, the radio and appliance dealer can do a considerable job for himself. As one example, he should take the measurements not only of the floor dimensions, but also of the ceiling height, the unbroken wall areas, the width and depth of window space, the degree of interference of pillars, etc. This should be done *before* a lease is signed, not after, as is often done. From these figures, he can then determine whether or not the space is adequate for his projected inventory and suitable for the type of display and merchandising procedure he has planned. He must keep in mind, however, that, while the store space is fixed, there is nothing inflexible about either his planned inventory or his merchandising procedure.

Item No. 3 represents a type of research and an expenditure that is not within the means of the small retailer. But even here he can make a number of moves of his own. For one thing, by personal observation, he can get an approximate idea of the extent of pedestrian traffic moving past a given location and how it is distributed over the periods of the day. By observation again, he can get a fair idea of what proportion of buyers enter the better-class retail establishments as against those going into the low-priced stores.

Retailing methods, Item No. 4, is again a broad study, but here, too, the small dealer can do something for himself. He can go from store to store and determine what class of merchandise is being handled in the immediate vicinity of his contemplated location, how customers are handled, what the reactions of the customers are to the type of merchandising that is now in effect in the vicinity.

This whole task of store location for the prospective radio and appliance dealer becomes considerably easier if he has lived a long time in the community and has become thoroughly familiar with its retail centers through long association. He may already have absorbed over the years much of the knowledge that he might gain by the procedures outlined. But, whether that is the case or not, the principles outlined in this discussion still hold and the guides given remain valid.

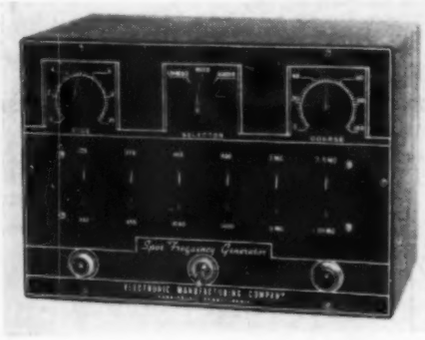
—30—

What's New in Radio

(*Continued from page* 82)

Designed for servicemen, it contains twelve preset frequencies chosen to cover 95 per-cent of the sets in use. Six switches are provided, and only a flip of the switch is necessary to select the desired frequency or change to another. A new feature is the single jack, which obviates the necessity for switching leads.

An electron coupled circuit assures



stability, while low leakage is effected through use of double shielding. The set, which operates on a.c., attenuates to less than one microvolt. The panel is of acid etched aluminum with a steel case.

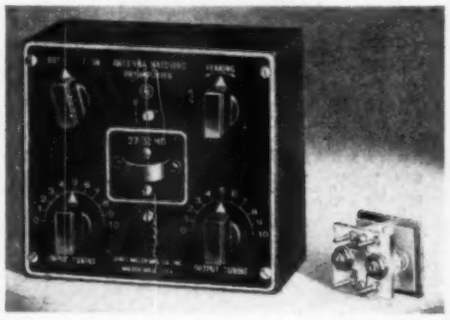
For further information on the Spot Frequency Generator write to *Electronic Manufacturing Company,* 714 Race St., Harrisburg, Pennsylvania.

PREAMPLIFIER

Combining engineering efforts with the *General Electric Company, James Millen Mfg. Co., Inc.,* has developed a new unit which incorporates an electronic impedance matching device with a broadband preamplifier, Model 92101.

The gain which can be achieved by this amplifier is dependent upon how well the antenna is matched to the receiver, with the amount also varying depending upon the make of receiver and type of antenna. With most receivers gain occurs at the 20, 10 and 6 meter bands and is usually considerably above 30 db. Once tuned the unit automatically matches the receiving antenna to the receiver.

In addition, the 6AK5 miniature



tube, with a transconductance of 5000 micromhos, serves as a broadband r.f. amplifier giving an additional gain in the order of 30 db. A voltage gain of approximately 35 can therefore be achieved with a plate load of 7000 ohms.

James Millen Mfg. Co., Inc., of Malden, Massachusetts, is the manufacturer.

HAND TOOL ATTACHMENTS

An inexpensive set of six attachments, developed especially for use with a portable electric hand tool, has been announced by the *Chicago Wheel & Mfg. Company.*

Compact enough to fit into a desk drawer, the attachments will control the accuracy of line and depth of cut on any and all materials. Thorough accuracy can be achieved in following fixtures, jigs, patterns, French curves, circles and intricate designs. The attachments permit perfect control of cut on hard materials such as glass and over twenty different molding cuts can be made. The attachments are light and adaptable permitting chamfers, radii and beveled molding cuts to be made quickly and precisely on large work.

Further details and prices on this attachment set can be obtained from the *Chicago Wheel & Mfg. Company,* 1101 W. Monroe, Chicago, Illinois.

NEW MICROPHONES

Two new crystal microphones have been announced by *Electro-Voice, Inc.,* Buchanan, Michigan. These microphones can be used on public address,

paging systems, radio amateur rigs, and similar installations.

Both the dynamic Model 610 and crystal Model 910 are enclosed in upright cases of metal finished in satinchrome. A 15° fixed tilt enables the case to be aimed at the sound source. For quality reproduction of voice and music, frequency response is substantially flat from 50-8000 c.p.s.. Polar pattern is non-directional at low frequencies, becoming directional at higher frequencies.

The dynamic model uses the new "Acoustalloy" diaphragm which withstands high humidity, extreme temperatures, salt air and severe mechanical shock. It uses Alnico V in the magnetic circuit and is available in Hi-Z (direct-to-grid, 25,000 ohms), 50, 250 or 500 ohms impedance. Output level is —53 db.

The crystal microphone employs a high capacity moisture-sealed crystal and duralumin diaphragm. It has high

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25 POUNDS OF SURPLUS INCLUDES:

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Chassis, Cabinet, Relay, Condensers, Resistors, Transformer, Coils, Sub Assemblies, Wire, Hardware, etc., etc.

WORTH AT LEAST $50.00

The same as above —10 lbs.....$3

25 lbs all for $5

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Universal Chassis with 9 Standard Socket Holes 3½x8¼x13	1.00
5" Speaker Min. .68 oz. magnet alnico #5, min. 1.6 oz. magnet alnico #3, voice coil imp. 3.2 ohms. Each	1.50
At least 150 resistors and condensers mounted on terminal boards will be worth your while to buy and strip, per kit	2.00
100 assorted resistors and condensers and r.f. chokes, etc., per kit	2.00
100 assorted resistors ½, 1 and 2 watt, per kit	2.00
Universal output transformer. Each	1.00
Electrolitic cond. 10 mfd 150 v. Each	.35
Variable condenser 140 mmf. Each	1.25
Octal sockets. Each	.07
10 for 60c. 100 for	5.00
Loctal sockets. Each	.10
Pilot Lite Sockets. Bayonet type. Each	.07
SPST Toggle Switch. Each	.20
½ Meg. Volume Control. Each	.30
1 Meg. Volume Control. Each	.30

Terrific Savings on These Popular AC-DC Universal "BUILD YOUR OWN" PREPARED KITS

BUILD A CODE OSCILLATOR (Audio)

Kit Includes:

- 2 Tubes 1-12sn7 1-6H6
- 2 Sockets
- 2 Resistors 1-100K 1-2K
- 3 Condensers 1-.001, 1-.01, 1-.005
- 1 Chassis
- Hook-up wire & Diagram
- 1 Oscillator coil
- 2 Electro Condensers
- 1 Line cord
- 1 Key

SPECIAL VALUE $4 Per Kit

BUILD A RECEIVER!

Frequency 2-30 MC

Kit Includes:

- 1 Chassis 5x33/4x3
- 2 Octal Sockets
- 2 Condensers 100 MMFD
- 1 RF Choke 2.5 M.H.
- 4 Resistors 1-50 M 1-3 Meg., 1-5 M. 1-250 M
- 1 Slug Tuned Coil
- 1 5M Ohm Volume Control
- 2 Filter Condensers
- 1 Toggle Switch
- 1 Roll Coil Wire
- Hook-up Wire and Hardware
- 2 Mica Condensers .003 Diagram Included
- 2 Tubes 1-12 SN7 1-6 SL7
- 1 Condenser 330 MMFD
- 2 125 Ohm 10 Watt W. W. Resistors

Special Value $4 Per Kit

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3 OUTSTANDING FEATURES

- #1 270 V.D.C. @ 150 MA. 1.5% Ripple
- #2 110 V.A.C. isolated @ 250 Watts
- #3 Bias Voltage—100 V. @ 40 MA.

Kit Includes:

- 1 Transformer
- 2 Sockets (Octal)
- 1 Dual choke 3 Hy.-15 Hy
- 1 100 K ½ Watt
- 1 Toggle Switch
- 1 Line Cord
- 1 Chassis 10½x6½x3
- 1 Fuse Holder
- 1 Outlet Socket
- 1 8.5x8.5 Condenser
- 1 Hook-up Wire & Diagram
- 2 Tubes 1-5R4GY 1-6X5
- 2 Condensers 1-2MFD 1-10 MFD 150 V
- 4 Resistors 2-10K 5 Watt 1-25K 10 Watt 1-1K ½ Watt
- 1 Pilot Lite Assembly

Less Bias Parts 1-6X5 Tube, 2 Resistors 1-10K 5 Watt 1-100K ½ Watt 1-Octal Socket 1-Condenser 2 MFD. per kit $10.00

SUPER VALUE $12 Per Kit

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Kit Includes:

- 1 Chassis 5x33/4x3
- 2 Octal Sockets
- 1 Toggle Switch
- 2 10 Watt W.W. Resistors 125 Ohm
- 2 Mica Condensers .003
- 1 100 M Resistor
- 1 Roll Coil Wire
- 2 Tubes 1-12 SN7 1-6SL7
- 2 Slug Tuned Coils
- 1 Filter Condenser
- 1 RF Choke 2.5 M.H.
- 1 Key Diagram Included
- 1 100 MMFD Mica Condenser
- Hook Up Wire and Hardware

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- 1 Chassis 5x33/4x3
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- 1 Resistor 5M ½ Watt
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- 1 Toggle Switch
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- 2 Filter Condensers Diagram Included
- Hook-Up Wire and Hardware

SUPER VALUE $5 Per Kit

BUILD A PHONOGRAPH OSCILLATOR

700 KC, 1400 KC

Kit Includes:

- 3 Tubes 1-6SJ7 1-6H6
- 1 Condenser .005
- 1 Rheostat 5K
- 2 Octal Sockets
- 2 Condensers
- 1 Chassis
- Hook-up Wire & Diagram
- 1 Oscillator Coil
- 3 Resistors ½ Watt 1-100K 1-5K 1-2K
- 2 125 ohm 10 Watt W.W. Resistors
- 1 Line Cord

SPECIAL VALUE $4 Per Kit

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impedance and an output of —48 db.

Compact in size, both microphones have a built-in cable-connector and come equipped with eight or twenty foot cables.

Electro-Voice, Inc., Buchanan, Michigan, will furnish additional details and prices upon request.

SUPREME TRANSMITTER

Supreme Transmitter Corporation has recently introduced their Model AF-100 desk type transmitter, designed for the radio amateur.

The six-band 100-watt output transmitter is housed in a metal cabinet. Covering the popular "ham" bands

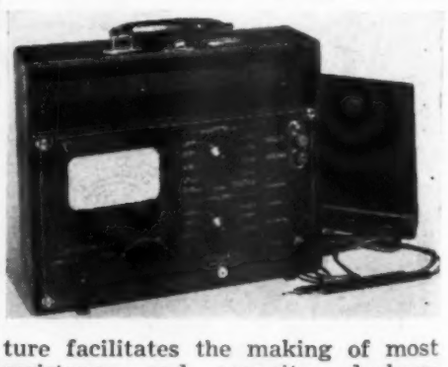
for c.w., i.c.w., AM, and FM phone transmission, it is the first transmitter with the FM feature in the 27.185 to 27.445, and 29 to 29.7 mc. bands. The transmitter is continuously tunable throughout the range of each "ham" band. A highly stable oscillator followed by slug-tuned buffer and doubler stages, ganged to the oscillator dial, simplifies working through severe QRM. Band changing is accomplished in the exciter by a band selector switch and in the final stage by plugging in a coil for the band selected. Meters are provided to indicate PA plate current, grid current, and modulator plate current. The power consumption is 325 watts.

Further information can be obtained from *Supreme Transmitter Corporation*, 280 Ninth Ave., New York, 1, New York.

BYOHMMETER MULTIMETER

A new feature, the Byohmmeter, has been added to the Model 796 multimeter which *rms Electronics* of Middle Village, New York is currently offering the trade.

According to the company, this fea-



ture facilitates the making of most resistance and capacitor leakage measurements without removing the component from the circuit.

The 796 Multimeter, in which the Byohmmeter is incorporated, will measure current and voltages from a full scale reading of 1 volt to 10,000 volts a.c. and d.c. with 1% accuracy.

The meter employs a 20,000 ohm/volt sensitivity plus a "meter fused" position and a "carry" position for transit.

Further information on the Byohmmeter and 796 Multimeter will be furnished upon request to *rms Electronics,* 73-39 68th Avenue, Middle Village, Long Island, New York.

-30-

54A Antenna Array
(*Continued from page* 53)

the receiving antenna. Change of array orientation produced the effect of moving the receiving antenna about the array.

Typical Patterns

It is not the purpose of this writer to predict just what particular field distributions will prove to be most desirable in the future. The two patterns here, which are easily obtainable with an array of two 54A antennas, are examples of the variety of field distributions which may be secured.

In the event that the transmitter site is chosen near one side of the area to be served, the field distribution of Fig. 2A should prove of real benefit in solving the problem of adequate service for the desired area and minimum loss of signal strength into areas in which there may be no listeners. The array power gain is 1.4. This array power gain is to be multiplied by the gain of a single element of the array, that is, a single 54A antenna, in order to determine the gain in the direction for which gain is a maximum. As indicated in Fig. 2A, the maximum gain is 6.6. It will be noted that the field intensity is considerably greater than that due to a single 54A antenna over one half-plane adjacent to the antenna site, while considerably reduced in the other half-plane.

Spacing of .325 wavelength between the two antennas in the array, and a relative current phasing of 117 degrees is required to produce this field distribution. The maximum intensity lies along the projection of the axis of the array, and minimum is in the opposite direction.

In the event that the area to be served is long and narrow, a pattern similar to Fig. 2B may be advantageous. The field intensity distribution illustrated is secured by spacing the antennas .5 wavelength and exciting them in phase. Under these conditions the array power gain in the maximum directions is 2, so that an array comprising two eight-element cloverleaf antennas would give a maximum power gain of 9.4.

Deep nulls or minima such as those in Fig. 2B will probably not be required in FM practice since it is not anticipated that protection against interference will be needed. An adjustment could readily have been made to make these minima less pronounced with only a small reduction in signal intensity in the maximum direction.

-30-

BIZ QUIZ

Test Your Sales Ability

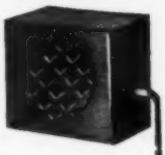
One of a series of sales aptitude tests especially prepared for RADIO NEWS by Mr. George Speer, Director of Institute for Psychological Service, Illinois Institute of Technology.

1. Would you rather play *(a) solitaire (b) checkers (c) poker*
2. Which book would you prefer to read? *(a) how to refinish furniture (b) magic made easy (c) the world of tomorrow*
3. Would you prefer to *(a) work alone (b) have your own job to do, but have other people around (c) work in cooperation with others*
4. If you are in low spirits do you *(a) try to find others to cheer you up (b) go to a movie to forget yourself for awhile (c) try to think of something cheerful*
5. Do you make new friends *(a) slowly (b) fairly easily (c) easily and rapidly*
6. Do you think you could become so interested in an invention you were working on that you would not notice a lack of intimate friends *(a) yes (b) no (c) can't say*
7. When you are with other people have you felt lonesome *(a) often (b) occasionally (c) never*
8. If a friend were describing you, which phrase would be more accurate *(a) he is very cautious (b) he is usually willing to take a chance (c) he is very reckless*
9. When you have a tough problem, do you usually *(a) figure it out alone (b) talk about it with other people, but make your own decision (c) seek and follow the advice of others*
10. The tailor promised to return your suit today, but when you call for it he informs you that he has just started to work on it. Are you more likely to *(a) complain strongly (b) tell him calmly that you are dissatisfied (c) accept it as something that cannot be helped*
11. If you were playing a game against an opponent known to be considerably more skillful than you are, would you *(a) realize you couldn't win, but try to make a decent score (b) hope for some kind of a lucky chance that might let you win (c) decide you were going to win in spite of his superior ability.*
12. Would you rather have a job *(a) with a moderate salary, but absolute security (b) with a large salary, but considerable insecurity (c) with a commission, both income and security depending on your own efforts*
13. Are your feelings *(a) rarely hurt (b) hurt sometimes (c) easily hurt*
14. If you unexpectedly found that you had to stay overnight in a strange city, where you knew no one, would you *(a) go to a movie (b) go to a street carnival (c) catch up on some reading or reports*
15. Do other people feel that you are *(a) understanding (b) indifferent (c) critical of them*
16. When you are told by your superiors how to do things, do you *(a) follow instructions if you must, but silently object (b) do as you are instructed without much thought about it (c) enter into the situation and carry out the instructions enthusiastically*
17. Are your best friends *(a) equal to you in ability (b) inferior to you in ability (c) superior to you in ability*
18. If you attend a sales conference led by a prominent executive, would you *(a) make every effort to meet him (b) wait for someone to introduce you to him (c) remain in the background but try to absorb his ideas*
19. If you were at a party where you knew about half of those present, and the party became somewhat dull, would you *(a) decide to go somewhere else (b) suggest something to enliven the affair (c) wait for someone else to suggest something*
20. You have a vague idea for a project in which you are interested. Do you find it easier to develop this idea by *(a) talking it over with other people (b) thinking about it alone (c) reading books or articles on the same subject.*

(Answers on page 155)

U. S. SIGNAL CORPS 2-WAY TALKING SYSTEM

A Western Electric product. Use them for inter-office communication, house to garage, mother's room to baby's room, on the farm and many other places. Sensitive enough to pick up the slightest whimper. Sturdy all steel construction. Has push-to-talk switch. Speaker is built in. Tube line-up 5Y3, 6SJ7 and 6K6. Can be used as a 4-watt modulator for your ham rig. The small unit is a speaker-receiver. Connect as many as 10 speakers in parallel. Comes ready to operate. Just plug into 110 volt AC line. 100 ft. of speaker cable is supplied. Complete with master and one speaker-receiver..... **$32.50**



Extra speaker-receiver..... **$4.95**

10 METER CONVERTER

27 to 30 Megacycles

Designed for Army surplus receivers such as the BC 342, BC 348, BC 312, etc. Uses a single 6SA7 fixed oscillator at 16 megs. Adjust plate output and grid input signal for maximum. Calibrate and tune the entire band on your receiver. The power for the converter comes from the receiver. Our special adapter secures the power from the receiver by a plug-in arrangement. When this is not possible instructions will indicate the correct tapping point. In ordering be sure to mention the model receiver.

Complete Instructions and plans..... **$1.00**

Kit of parts and plans for complete operation. **$12.00**

Complete unit wired and tested... **$18.00**

RADIO PARTS ASSORTMENT

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A Better Buy
10 lbs. $1.69

HS-30 HEARING AID TYPE HEADSET

Hi-fidelity, flat, from 100 to 10,000 cycles, impedance 128 Ohms, will operate across low impedance voice coil. With matching transformer impedance is 8000 ohms. Brand new, complete with plug and transformer..... **$1.98**

HS-16 HEADSET

Noise-proof, rubber-cushioned, equipped with 2 matching transformers, magnesium earcaps. A superior headset. 8000 ohms impedance. Brand new... **$2.98**

HOT SPECIALS

1619 Tube. Characteristics same as 6L6 only with a 2½ volt filament. Use as a replacement for a 47 or a 2A5..... **$ .69**

20.7 Megacycle double iron core tuned IF transformers. Four to a complete set. Use them for FM or Video. Can easily be trimmed down to 10 Megs with a single ceramic condenser. Set of four matched coils..... **$2.98**

6L6 Output transformer..... **$1.79**

2500 Ohm 100 Watt adjustable resistor.. **$ .49**

Kit of 50-1 and 2 Watt resistors, sizes 25, 150, 1000, 3000, etc..... **$1.00**

BC-312, 342 I.F. Crystal Transformer, resonant at 470 KC. Replace that 1st I.F. with this unit and separate those crowded ham-bands..... **$6.49**

Double Button Mike-to-Grid Trans.... **$ .59**

Kit of 10 R.F. & Osc. Coils..... **$ .98**

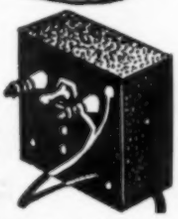
Pwr.-Trans. 350-0-350, 60 Mils, 6.3v @ 3a, 5v @ 2a..... **$2.15**

RA-20 Power Supply—for Signal Corps Receiver BC-342. Replace battery pack on BC-312 to convert to 110v, AC operation..... **$14.89**

Output Transformer—Pri. 10,000 Ohms, Sec. 4,000 250, 4 Ohms..... **$ .69**

BROADCAST BAND CONVERTER

100 KC to 1550 KC



For owners of Army-Navy surplus receivers. Adapter supplied uses a 6SA7 tube mixer-oscillator. Beats BC signal against 3 Megs. Tune in on short wave. Tested with BC-312, 342, NC100-ASD, BC-348 and others. In ordering state model... **$15.00**

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4 TUBE AMPLIFIER (2-7C5, 7F7, 7Y4). Used as electronic supercharger control. 110V, 400 cycle. Black crackle finish case & slide-in chassis. Contains: power trans, 7 mica & oil cond, 7 resistors, 4 loctal sockets plus other components worth several times the price. 8¾"x4½"x3¾". Less tubes..... 1.49

POWER RHEOSTATS. Hvy duty, standard brands. 25 watt—20, 50, 100, 200, 375, 500 or 1000 ohms..... .89

50 watt—2, 40, 75, 250, 500, 3K, 7.5K or 10K ohms..... 1.29

SPECIAL!!—50 watt—15 ohm..... .98

Cathode Ray Tube Socket. 14 prong..... .49

9 ft. Whip Antenna. Flexible, lightweight (8 oz.). 10 sections. Weatherproof finish..... 1.39

Antenna Base. Heavy duty, adjustable 180 degrees. Mtg. 6¼"x4½". Complete with hardware..... .49

Binding Posts (TM-175) Hvy. duty plated brass, needle contact, knurled head. 2" O.D., ¾" high—12 for..... 1.00

HEADPHONES — Army HS-33, 2000 ohms. Leather covered, adj. forks. With PL-54 plug 1.25
Rubber phone cushions for above, pair..... .20
Headbands (HS-33) only, with PL-54 & cord... .39
PL-54 plug & 13" tipped double phone cord... .19
JK-26 ext. jack for PL-54. Bakelite shell..... .23

Frequency Meter Tech. Manual (Navy) Theory & operation. 39 illust. & diagrams. 58 pp. .15

"FM" Tech. Manual (Army) 86 illust. 49 diagrams. 240 pp..... .39

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	Bar in shorter lengths, per inch	.12
#	2—Face 1¼"x1¾"x⅞" high	.98
#	3—Heavy duty bar, 2¼"x1⅜"x5/16"...	.98
#	4—Face ¾"x¾"x⅝" high	.39
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#	6—Polished bar, 9/16"x¼"x1⅛"—20 for..	1.00
#	Face ½"x1⅛"x¾" high	.10
#	8—ALNICO V, horseshoe, poles ⅝" sq.; 1¼" high	.75
#	9—ALNICO V, horseshoe, poles 9/16" sq.; 1⅛" high	.98
#	10—ALNICO V, horseshoe, poles 1"x1½"; 2¾" high	5.95
#	11—H'shoe; ea. pole 11/16" O.D.; 2¼" high	1.29
#	12—(Similar to #5) ⅝"x⅜"x7/16"	.35
#	14—Polished hvy. duty bar, 3"x1¼"x⅞" (magnetised lengthwise, wide or narrow sides)	1.29

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#	7—Escutcheon Plates; 25 asstd. airplane, slide-rule & full-vision types	2.95
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#	20—**SPEAKER REPAIR KIT.** A real money & time saver. Contains: 20 asstd. paper rings, 10 spiders, 25 asstd. voice coil forms, 3 yds. felt strips, 20 chamois leather segments, kit of 16 shims & tube of spkr. cement. All for	2.49
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Brand new RCA UX-200 tubes in sealed cartons. Ideal triode detector	.8 for 1.00

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Double Pole, 5 position	0.29
Double pole, 6 position, 2 decks	.39
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RADIO HARDWARE TREASURE. Over 1000 screws, nuts, washers, lugs, etc. PLUS handy 36 compartment cardboard kit box..... .59

EXPERIMENTAL TUBES. 20 asstd. sizes & base types for testing, research, etc. Fil. tested.... 1.00

CAN & CHASSIS FOUNDATION. 5 tube punched chassis & cover. Cadmium plated steel. 11"x9½"x4½"..... .95

Celotex Speaker Baffles. 14"x14"x½". Specify size of speaker..... .35

ALUMINUM PANELS (.072"): 8"x6"..... .39
8"x8"....$0.49; 8"x10"....$0.59; 8"x15"..... .79

BAKELITE PANELS: ⅛" glossy brown. 7"x10".. .59
7"x14"....$0.69; 7"x18"....$0.79; 9"x14"..... .85
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Speaker Grille Cloth. Decorative gold or silver weave. Per square foot..... .20

Victor Power Transformer for models R-32, 45, 52 or 75. Unfinished..... 5.95

DPDT TOGGLE SWITCHES H&H 6A/125V, external lugs, bakelite case. Split ball..... .39

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WORTH 2-0284-5
12,000 SQ FT OF RADIO PARTS

Build This R-C Bridge

(*Continued from page* 63)

nect this shield to chassis *at both ends.* This is very important in order to eliminate extraneous pickup, especially if this lead runs for more than about 1 inch. Fig. 5 shows this procedure to have been followed in the author's bridge. Note that the lead from the sensitivity control has been enclosed in shield braid.

A single return point (ground) must be employed in the 6SJ7 stage; and J_1 R_{11}, R_{13}, C_{13}, and C_6 must be connected to this point. The most logical point is the No. 1 contact of the 6SJ7 socket, since this contact also grounds the tube shell. The common return point is connected to chassis by means of a short, direct lead.

Signal input jack J_2 must be insulated from the chassis and panel. It may be seen supported by a bakelite washer in a large clearance hole in the panel, in Fig. 1.

Adjustment and Calibration

After the wiring has been checked; remove the 6SJ7 and 6E5 tubes from their sockets, open the lead between filter capacitor C_{11} and the OD3/VR150 tube at the point marked "*X*" in Fig. 2, and insert a 0-50 d.c. milliammeter in this line. The negative terminal of the meter must be connected to the regulator tube. Set the slider on R_{10} at a trial point about ¼ of the way from the C_{11} end of this resistor, insert the line plug into a 115-volt a.c. outlet, and throw switch S_2 to its "On" position. Note the milliammeter reading. Again set the slider on R_{10} carefully to give a milliammeter deflection of exactly 30 ma. and tighten the slider at this point. The voltage regulator now has been adjusted; and the milliammeter may be removed from the circuit, the connection "*X*" restored, and the 6SJ7 and 6E5 tubes returned to their sockets.

The bridge calibration is made with an assortment of accurately known resistors—with range switch S_1 in its No. 5 (Rx1000) position. For the calibration, obtain resistors having as many as possible of the following values: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1500, 2000, 2500, 3000, 3500, 4000, 4500, 5000, 5500, 6000, 6500, 7000, 7500, 8000, 8500, 9000, 9500, 10,000, 11,000, 12,000, 13,000, 14,000, 15,000, 16,000, 17,000, 18,000, 19,000, 20,000, 25,000, 30,000, 35,000, 40,000, 45,000, 50,000, 55,000, 60,000, 65,000, 70,000, 80,000, 90,000, 100,000, 150,000, 200,000, 250,000, 300,000, 400,000, 500,000, 1 megohm, and 10 megohms. The reader will see that a number of these values may be secured by connecting several of the lower values in series. If one or more decade resistance boxes are available, they may be used very satisfactorily to obtain the above values. Also, a series of volume control-type resistors might be set to the above calibration values, provided some means is available for measuring the control settings.

The following calibration procedure must be followed: (1) Connect bridge to 115-volt a.c. supply and throw switch S_2 to "On." (2) After tubes have heated and 6E5 indicator glows brightly, throw range switch to position 5 (Rx1000). (3) Connect 100-ohm resistor to measuring terminals. (4) Set sensitivity control so that 6E5 eye just closes, and adjust main dial (R_A) for null, as indicated by sharp, complete opening of 6E5 shadow. This null should be obtained at left-hand end of main dial. If it occurs at right-hand end of dial, reverse the two outside connections to potentiometer R_A. (5) Adjust sensitivity control R_1 for sharpest and clearest opening of eye pattern. (6) Mark this dial setting 0.1. (7) Repeat process with 200 ohm resistor, marking corresponding null point 0.2 on main dial. (8) Repeat with the various resistors listed earlier, marking dial points according to the following system: 100 ohms = .1, 200 ohms = .2, 1000 ohms = 1, 1500 ohms = 1.5, 10,000 = 10, 1 megohm = 1000, 10 megohms = 10,000, etc. The reading should be marked in hundreds up to and including 900, then from 1000 through 9500 divisions should be marked for each 500 ohms, from 10,000 to 20,000 should be marked in steps of 1000. From 25,000 through 65,000 markings should be at intervals of 5000. From 70,000 the readings should be marked at: 80,000; 90,000; 100,000; 150,000; 200,000; 250,000; 300,000; 400,000; 500,000; 1 megohm and 10 megohms.

It is not possible to calibrate a few points and then to divide the dial scale by hand to obtain the rest of the graduations since *response* of potentiometer R_A is not linear. It becomes necessary therefore to calibrate as many individual points as practicable. If the reader has the required resistors, he is advised to calibrate even more points between 500,000 ohms and 10 megohms than we have suggested.

After the calibration is completed, the dial scale may be drawn-in permanently with black India ink and covered with transparent celluloid or other plastic, to prevent soiling and marring.

Operation

Use of the bridge is straightforward and rapid. (1) Switch-on bridge power. (2) Connect capacitor or resistor to be tested to the *"Measuring Terminals."* (3) Set range switch S_1 to trial resistance or capacitance range. (4) Set sensitivity control R_1 so that 6E5 eye just closes, and adjust main dial for null, as indicated by wide, clear opening of 6E5 eye at some point along dial range. (5) Adjust sensitivity control R_1 for clearest and least "jumpy" operation of eye. (6) Read capacitance or resistance value on main dial and multiply dial reading by multiplier indicated by range switch setting. (7) If null is not found, switch to next R or C range, as case may be, and repeat adjustments. (8) If null occurs in upper fifth of main dial, where divisions are crowded and comparatively

difficult to read, switch to next highest range to obtain null in wide open (more accurate to read) portion of dial.

A capacitor with high power factor or low Q may be discovered by a fuzzy appearance of the edges of the 6E5 shadow pattern *at null.* If no null point is found (either with a resistor or capacitor under test) and the eye opens sharply at the extreme right-hand (full-scale) setting of the dial, an *open circuit* is indicated. If no null point is found and the eye opens sharply at the extreme left-hand (zero) setting of the dial, a *short circuit* is indicated. An intermittent is shown by a flickering of the eye at null, especially if the capacitor or resistor under test is rapped sharply.

The operator will observe that by advancing sensitivity control R_1 the bridge may be made so sensitive that the eye indicator responds to individual wire turns of potentiometer R_A as the main dial is adjusted!

If it is desired to employ some other bridge signal frequency than 60 cycles, obtain the desired frequency from an audio oscillator or combination of oscillator and audio amplifier, plugging the output of the external signal source into jack J_2. When the plug is inserted into this jack, the internal 60-cycle signal source will be removed from the bridge automatically.

If it is desired to use some other null detector than the magic eye tube, plug the external detector into jack J_1. This connection will not disturb the bridge operation and no changes need be made. The bridge sensitivity control will have no effect upon the external detector; however, this will be no disadvantage, since, in most cases, external null detectors have gain controls or input voltage adjustments of their own.

—30—

AVOID HUM AND NOISE

WHEN there is considerable slack in the radio line cord the tidy housewife is likely to coil this wire inside the radio cabinet as shown.

Inductive coupling to the a.c. line may result in hum and noise.

The cord should be kept clear of all parts and if too long—should be reduced in length, rather than placed inside the cabinet. . . . . H. L.

to activate a diaphragm and needle to do the cutting.[3]

In the early acoustical system, which was far from perfect, most of the harmonics and overtones were completely lost and even some of the fundamental waves, especially the low, or bass notes, failed to register. The adoption of the microphone amplifier and an electrically operated cutting stylus overcame most of the problems. The result was the production of much better records.

The earliest forms of electrical pickups were of the *carbon* or *magnetic* types. In 1927 a new pickup was introduced which relied on the *capacity* effect of its elements. Both the carbon and the magnetic types of pickup, although superior to the old acoustical pickups were far from perfect and their faults were many. For instance, in the carbon type the instability of the carbon granules caused a fuzzy blowing sound. These carbon granules soon became packed when electrical current passed through them and they would adhere to one another. In addition, the modulated electrical current was far from being an exact duplicate of the sound waves that were cut on the record.

In the magnetic type there was the problem of inertia from the relatively heavy iron armature which was held by a stiff spring to overcome the magnetic pull of the pole pieces and to prevent the armature from "freezing" to one of the pole pieces. Thus the inertia of the heavy iron armature and the tension of the spring made it very difficult for the instrument to respond to the delicate harmonics and overtones. The natural frequency of vibration of the armature, which was in the audio range, caused a blasting on certain notes. Furthermore, the energy generated by the movement of the armature to and from the pole pieces was in direct proportion to the square of the distance of travel. That meant that the current output was distorted relative to the sound waves cut on the record. It should be pointed out that the modern magnetic pickup has overcome these difficulties.

The Capacity Pickup

The new capacity or "modulator" pickup, as it was then called, is illustrated in Fig. 9. The diagram briefly explains the system. The first tube is oscillating at a frequency governed by the inductances of L_1 and L_2 and the capacity, C. Any conventional oscillating circuit may be used with this pickup. Inductively coupled to the oscillating coil is a pickup coil, L_3, which is in series with a capacity type pickup and $C_1 - C_2$ and a radio frequency transformer, *R.F.*, which is

[3] Jewell, F. A., "Combining the Phonograph and Radio," RADIO NEWS, April, 1927, page 1238.

broadly tuned to the frequency of the oscillations. The amount of radio frequency current flowing in the primary of the r.f. transformer is governed by the capacity of C_1 — C_2. Plate C_1 is fixed, while C_2 vibrates, causing a variable radio frequency current to flow in the circuit in exact proportion to the vibration. C_2 is fastened to a stylus that is traveling in a groove on the record and is vibrated by the sound waves cut in the record groove. Thus, the modulated r.f. current flowing in the primary of the r.f. transformer is transferred to the secondary and rectified by any of the conventional detector circuits, passed through the usual filter circuit and then on to the audio amplifier and loudspeaker.

Inasmuch as the frequency passing through C_1-C_2 is very high, these plates are mechanically very small. Consequently, the vibrating member is very light, usually being made of aluminum. As this vibrating member does not have to perform any appreciable mechanical work (such as moving an air column or working against a heavy spring tension, as in a magnetic type pickup) it is allowed to "float" in the record groove. As it has very little inertia, it can readily respond to all the delicate overtones as well as all the fundamental notes. There is only one frequency to contend with, that of the oscillator, and since the only function of the capacity type of pickup is to vary the amplitude of this frequency, no difficulty was encountered in designing a circuit that would respond to the variations.

When the modulated radio frequency current is rectified in the detector circuit and filtered, an electrical wave which exactly corresponds to the sound waves put on the record is transmitted to the audio amplifier for additional reinforcement.

Thus we have the transition from earliest acoustical systems to electrical recording techniques.

Sound on Disc

Present day records are the result of modulated grooves which have been

Fig. 8. Simplified process for recording and reproducing acoustical records.

cut on to a revolving wax plate or disc. From this disc, through intricate processing, are made the pressings familiar to all of you in the form of records purchased at your local record store. The basic media for making the necessary engravings or modulations on the disc are by means of a "cutter" which may be either magnetic, crystal or some of the new forms of dynamic instruments.

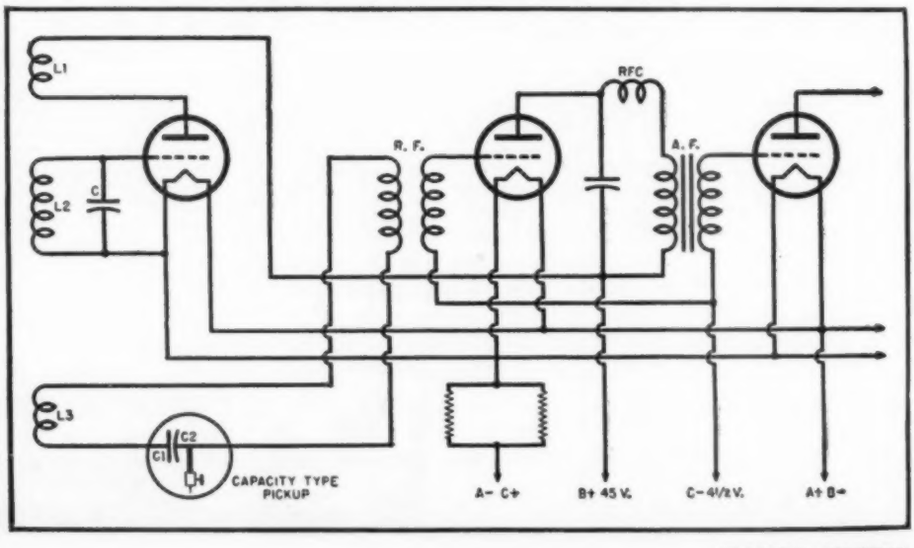
In order to understand what actually takes place at the cutting head, it is necessary to visualize the action of the stylus (the cutting needle) as it swings from side to side within the record groove. Its operation is similar to that of an engraving process done by hand. Instead of the hand guiding a cutting tool, a magnet or other source for actuating the cutting needle is used.

If a magnet is arranged as shown in Fig. 10, and a coil of wire placed in the position indicated, the magnetic field will be disturbed if a varying current (sound) is passed through the coil. If an iron armature is placed within the coil and a cutting stylus attached, this disturbance will actually move the armature back and forth within the field set up by the poles of the magnet.

This side-to-side motion does the engraving (modulating) on the walls of the groove. The high notes cause very small engravings, while the low bass notes actually cut deeper into the walls which are the sides of the groove. In other words, the action becomes more violent as the notes become lower. Bass notes, as a rule, have greater power or amplitude than high notes. This accounts for a greater swing of the cutting stylus from side to side.

From this explanation, we see that we must not give the low notes too

Fig. 9. How the capacity pickup of 1927 was connected to an audio amplifier.



much power from the amplifier. To do so would cause the needle to cut right over to the adjacent grooves which would spoil the record. Fig. 10 illustrates how these notes appear on the record. The illustration is greatly enlarged for detail. Observe how the grooves take on the appearance of a winding stream as it might look to a pilot in an airplane from a high altitude. These grooves appear as straight lines when the needle is at rest. That is, the side-to-side motion stops and the groove is left unmodulated or free from sound.

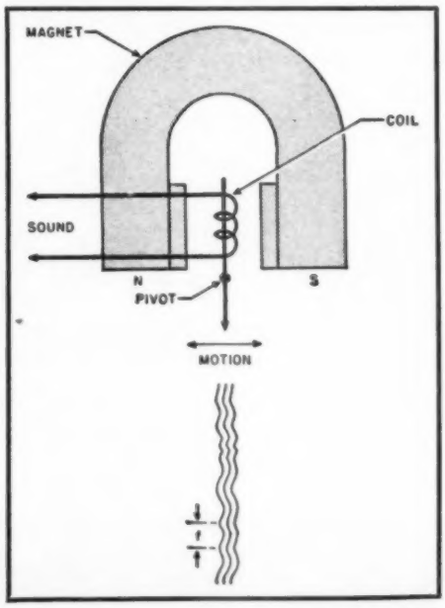
To complete the explanation, let us begin at the microphone and follow the sound waves all the way to the cutting stylus resting on the disc.

The sound waves are set up by the person speaking into the microphone. These waves actuate the mike in such a manner that these minute waves set up electrical variations in current in the microphone which follow the sound waves in cadence. These electrical current variations, although extremely small, pass through an audio amplifier where they are amplified to a value high enough to furnish audio power to the cutter and to move the cutting needle (stylus) which is resting on the revolving recording disc.

It stands to reason that if these current variations were weak, the cutting stylus would not receive enough power at the cutting head to drive the stylus from side to side in the groove. The result would be too much surface noise and not enough sound when the record was reproduced. On the other hand, if too much power is used, a poor record results, as will be explained in later articles.

Not only must the cutting stylus modulate the sound into the groove but, in modern practice, must also chisel out the groove itself. Thus, we have two basic actions: One, the creation or cutting of the grooves into the record material, which in the case of

Fig. 10. Simplified construction of the electro-magnetic cutter and its action.



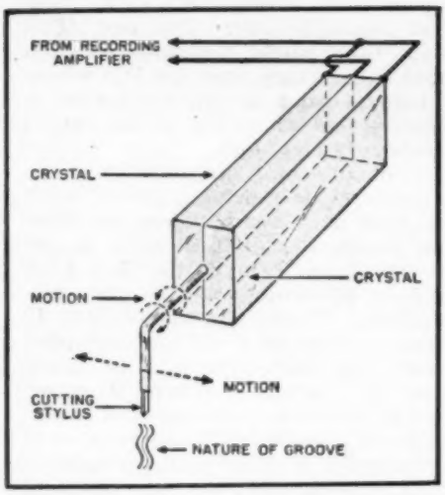


Fig. 11. How the crystal cutter modulates a groove when under electrical stress.

home recording, consists of a glass, paper, or steel base disc coated with lacquer, some form of acetate, etc. Second, the side-to-side vibrations of the stylus will be created from the sound entering the cutting head. Hence, modulation takes place at the same time the groove is being cut. The *groove* itself is that part of the material which is cut or chiseled out of the record. The *land* is that part of the disc remaining uncut between grooves. The material chiseled out by means of the cutting stylus is called the *chip* or *scrap*.

The Crystal Cutter

The piezoelectric crystal may be likened to a motor since it converts electricity into mechanical motion. There are two commonly used combinations of crystal elements known as the *bender* and *twister* types. The names *bender* and *twister* have been selected as they indicate the resulting motion of the crystal cutter when an electrical potential is applied. Both bender and twister elements, because of their multiple plate construction, are further classified as "bimorphs."

When audio power from the amplifier is applied to a crystal cutter, see Fig. 11, an electrical stress causes the lever connected to the cutting stylus to twist back and forth and to follow the sound waves that appear as electrical current variations.

Modulation is accomplished by the same chiseling action and the groove is modulated the same as with a magnetic cutter.

There is a distinct difference, however, in the behavior of crystal and magnetic cutters. Their complete characteristics and construction will be covered in later articles.

Thus, we have a brief explanation of capacitive, magnetic, and crystal cutters, all of which employ an engraving action on a revolving disc. Next month we will discuss systems for embossing on disc, sound on film, embossing on film, magnetic recording on film and the latest magnetic recording systems for tape, disc and wire.

(To be continued)

Deluxe Transmitter

(*Continued from page* 76)

load. The plate efficiency is approximately 38%.

Higher Power Triode Oscillator.

Among the triode oscillators, the HK24 or *Eimac* 25T or similar tube appears to have the most promising characteristics. The circuit is shown in Fig. 4A.

The data is as follows: (3.5 mc. operation)

With a plate potential of 750 volts, and an r.f. load of 17 watts, the plate current is 42 ma., the r.f crystal current is 8 ma., and the plate efficiency is approximately 53%.

With a plate potential of 1000 volts, and an r.f. load of 30 watts, the plate current is 60 ma., the r.f. crystal current is 16 ma., and the plate efficiency is approximately 50%.

From the above data it will be seen that for lowest crystal current, which results in the greatest frequency stability, the choice lies between the circuits using the 802, 6V6, or 7C5 tubes.

In the 802 circuit, the regeneration control may require adjustment for operation on different frequencies. Since this control is rather critical, a tube not requiring external regeneration is preferable. There is little choice between the 6V6 and 7C5 oscillators at 3.5 mc., but at higher frequencies, the 7C5 type offers some advantages, since the base insulation is superior, and the internal leads of the tube are shorter.

It is very important when using beam tubes or pentodes, to take care that the screen dissipation is not exceeded. If the tube is overdriven, or if the voltage is too high, secondary emission will result.

Frequency Multiplier Stage

With the tubes now available, it is no longer necessary to use a series of frequency doubling stages in order to obtain the desired output frequency. It is a relatively simple matter to obtain multiplication of from 2 to 20 in a single stage. The selection of the multiplier tube will depend upon the amount of multiplication desired as well as the output required from the multiplier. The most satisfactory tubes for use in a multiplier circuit appear to be either a 7C5 or the new 2E26 beam tetrode. The new 50B5 beam tube would probably be even more satisfactory than the 7C5 where a higher order of multiplication is required and where the power output can be relatively low.

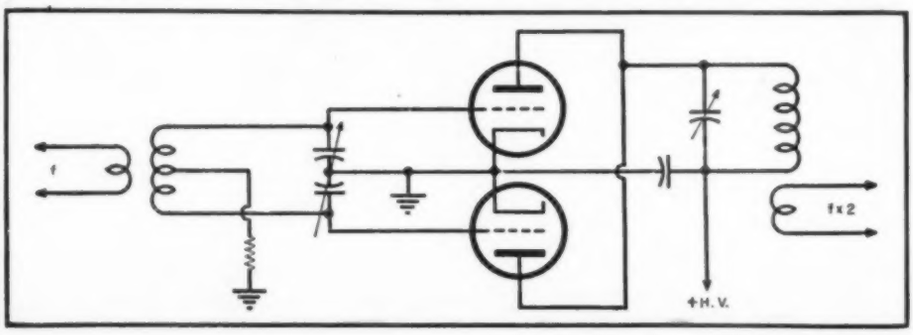
If the following amplifier stage requires very low driving power as in the case of a beam power amplifier and where the multiplication is not greater than 5 to 8, the 7C5 (and also the 50B5 tube) will be quite satisfactory. Where a power of 10 to 15 watts is required from the multiplier stage, the 2E26 tube will be found more satisfactory. Where it is desirable to obtain high orders of multiplication a single 2E26 may be used as a multiplier to drive a 2E26 amplifier. With this combination an output of 15 to 20 watts is obtainable at multiples of the oscillator frequency up to and including 25.

For the transmitter being described a 7C5 multiplier tube follows the oscillator stage and supplies more than sufficient drive to the 4E27 amplifier stage at multiples of 2, 3, and 4 times the crystal frequency. The circuit is shown schematically in Fig. 4B. In the original setup, a 2E26 was used in the multiplier stage but it was found difficult to reduce the drive to the 4E27 stage to a sufficiently low level for satisfactory operation. For this reason the 2E26 was replaced by a 7C5 multiplier tube. The plate tank circuit of the multiplier stage is arranged with a tap switch in such a manner that operation at 14, 21, and 28 mc. may be obtained without physically changing the coils. When the transmitter was placed into operation it was found necessary to further reduce the drive to the 4E27 amplifier. This was done by dropping the plate voltage applied to the 7C5 multiplier to 150 volts.

Other Frequency Multiplier Systems

Frequency multiplier systems are generally so well-known and have been treated so thoroughly in previous publications that little more need be said about them, except in a general way. Almost any single-ended amplifier circuit will operate satisfactorily as a frequency multiplier at frequencies up to 30 mc., with the pentode and beam tubes probably heading the list in performance. At the higher

Fig. 7. Schematic diagram of a push-push doubler used where high second harmonic output is desired. Tubes of high power gain operate exceptionally well in this circuit.



frequencies, the problem of obtaining satisfactory operation of frequency multipliers becomes more difficult, if any appreciable output power is required. If an extremely low output will be sufficient, the low capacity receiving type of tube may be used quite satisfactorily.

For those desiring to operate on the higher frequencies, and particularly where the multiplier is to be used as a driver and must supply an appreciable amount of power, the push-pull tripler will be found very satisfactory. The basic circuit is shown schematically in Fig. 5.

In this system, the ability of a push-pull amplifier to suppress the second harmonic and at the same time generate third harmonics is utilized.

The grid bias should be somewhat higher than in a conventional doubler stage for proper operation. This system is particularly suited to the frequencies where best operation dictates a conversion from the conventional coil tank circuits to resonant lines, such as from 48 mc. to 144 mc. A conventional coil is used in the grid circuit, while a tuned line is used in the plate circuit. This provides an arrangement with the tube capacities effectively in series, and permits the use of a sufficiently high inductance in the plate circuit for efficient operation.

With this arrangement, using two HK24s or similar tubes with a plate potential of 650 volts, an output power of 25 watts is available at frequencies up to 170 mc.

A modification of this system provides outputs at 1, 2, and 3 times the input frequency. This arrangement is shown in Fig. 6, and is a combination of a push-pull amplifier or push-pull tripler, and the almost forgotten "push-push" doubler arrangement, which may become popular if the proposed 21 mc. band is opened to the amateurs, as it will provide output on 7 mc. for instance, as a neutralized amplifier, 14 mc. as "push-push" doublers, and 21 mc. as a push-pull tripler.

The "push-push" doubler is an old standard where large output is desired from a doubler, but with the high efficiency of the pentode and beam type of tubes, and has all but been forgotten. It should be remembered however that the new tubes having high power gain will also operate exceedingly well in this circuit. Just as a reminder, the "push-push" doubler circuit is shown schematically in Fig. 7. It is particularly well suited to the 829B type of tube, as well as any of the twin triode types.

(Concluded next month)

ANSWERS TO BIZ QUIZ

1. c	6. b	11. c	16. c
2. b	7. c	12. c	17. b
3. b	8. b	13. a	18. a
4. a	9. b	14. b	19. b
5. c	10. a	15. a	20. c

ARE YOU A SALESMAN? Give yourself 5 points for each answer you had checked correctly. A score of 45 is average, and 75 or better is very good indeed.

International Short-Wave

(*Continued from page* 116)

from Chungking at 9 a.m.; at that time, however, there is usually severe CWQRM experienced.

Czechoslovakia—English news read by a woman is heard around 3:45 p.m. from OLR2A, 6.010, Pague. (Salmon) Is heard some afternoons in Eastern U.S., fair level.

An *English* news period has been added for 1:45-2 p.m. and is radiated over OLR3A, 9.553; good signals in Canada, fair in Eastern U.S.

Denmark—OZH2, 15.320, has been heard at low level in West Virginia recently at 11:58 a.m., announcing in *English* as "Radio Denmark." (McLaughlin)

Egypt—SUP2, 6.820, Cairo, used mostly for special relays, has recently been heard in England in foreign language and with Eastern-type music around 9-9:30 a.m. (Harrison)

Formosa—XUPA, 9.69, is scheduled from 6-7:30 p.m., 11 p.m.-12 midnight, and 4-9:20 a.m., according to British sources. (*ISWC*)

France—The French Radio, Paris, broadcasts to Britain daily between 4-5 p.m. on 9.56. (ISWC)

Paris is again being heard in Europe on a prewar frequency of 7.240, but is listed as Baden-Baden by the French radio journal, "Radio 46;" heard in Sweden around 4:30 p.m. (Skoog)

French Equatorial Africa—I've noted lately that *Radio Brazzaville's English* news at 12:30 a.m., directed to Western U.S., Canada, and New Zealand, on 11.970 and 9.440, is sometimes also carried on 9.984. In North Carolina, says Grady C. Ferguson, this transmission is heard on 17.530 also. Arthur Cushen, New Zealand, reports a "terrific" signal from the 11.970 channel.

French Indo-China—DXers "Down Under" report Pnompenh (or Penonperh), 12.364, is heard 7-7:55 a.m., with an *English* newscast at 7:45 a.m.; poor signal. New Zealanders list this as the "Voice of Viet Nam," and say location may be Hanoi.

Radio Saigon's first daily transmission now runs 6-8 p.m.; opens with setting-up exercises (given by man in French); French news at 6:30 p.m. and news in *English* (read by a woman) at 7:45 p.m.; announces next *English* newscast for 5 a.m. and has a further *English* newscast at 9 a.m.; frequencies are 11.78 and 4.81. The 11.78 frequency is in the clear evenings here in West Virginia between 6:15-7 p.m.; at other times during this particular transmission, there is interference from the powerful U. S. transmitter on 11.79. Has good signal in East around 5 a.m.

Germany—Leipzig, officially listed as 9.733, but reported heard on about 9.728, is being heard widely afternoons with good signal. Is heard in Britain around 12 midnight (Tonks). Kenneth Beach, Maine, lists peak as 4 p.m.

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1.25	.74	.67	.63	.59
1.35	.82	.74	.70	.66
1.50	.92	.83	.78	.74
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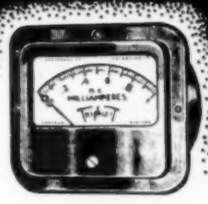
0-500 DC Milliamps
5-0-5 DC Milliamps
0-5 DC Amperes
0-10 DC Amperes
0-15 DC Amperes
0-5 DC V. 125 Ω/v
0-7 5 DC V. 125 Ω/v
0-10 DC V. 125 Ω/v
0-15 DC V. 125 Ω/v
0-200 DC V. 125 Ω/v
0-250 DC V. 125 Ω/v
0-500 DC V. 125 Ω/v
0-100 DC V. 1000 Ω/v
0-150 DC V. 1000 Ω/v
0-250 DC V. 1000 Ω/v
0-300 DC V. 1000 Ω/v

MODEL 231
0-15 AC Milliamps
0-25 AC Milliamps
0-100 AC Milliamps
0-250 AC Milliamps
0-500 AC Milliamps
0-3 AC Amperes
0-15 AC Amperes
0-25 AC Amperes
0-30 AC Amperes
0-3 AC Volts
0-5 AC Volts
0-10 AC Volts
0-50 AC Volts

MODEL 321
0-50 DC Microamp
0-200 DC Microamp
0-5 DC Milliamps
0-10 DC Milliamps
0-25 DC Milliamps
0-50 DC Milliamps
0-75 DC Milliamps

0-100 DC Milliamps
0-150 DC Milliamps
0-200 DC Milliamps
0-300 DC Milliamps
0-400 DC Milliamps
0-1000 DC Milliamps
0-1 DC Amps
0-5 DC Amps
0-10 DC Amps
10-0-10 DC Amps
20-0-20 DC Amps
0-3 DC V. 125 Ω/v
0-10 DC V. 125 Ω/v
0-18 DC V. 125 Ω/v
0-25 DC V. 125 Ω/v
0-50 DC V. 125 Ω/v
0-200 DC V. 125 Ω/v
0-250 DC V. 125 Ω/v
0-100 DC V. 1000 Ω/v
0-150 DC V. 1000 Ω/v
0-250 DC V. 1000 Ω/v
0-300 DC V. 1000 Ω/v
0-500 DC V. 1000 Ω/v
0-1500 DC V. 1000 Ω/v

MODEL 331
0-10 AC Milliamps
0-15 AC Milliamps
0-25 AC Milliamps
0-50 AC Milliamps
0-100 AC Milliamps
0-500 AC Milliamps
0-1 AC Amperes
0-3 AC Amperes
0-5 AC Amperes
0-10 AC Amperes
0-25 AC Amperes
0-30 AC Amperes
0-50 AC Amperes
0-5 AC Volts
0-10 AC Volts
0-25 AC Volts
0-50 AC Volts
0-100 AC Volts
0-150 AC Volts
0-250 AC Volts
0-1000 AC Volts



MODELS 326 & 336
Body Dia 2-1/8" - Flange 3-1/8" x 2-15/16"

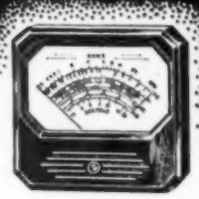
MODELS 421 & 431
Body Dia 2-3/4" - Flange 4-1/4" x 4"

MODEL 326
0-50 DC Milliamps
0-75 DC Milliamps
0-100 DC Milliamps
0-250 DC Milliamps
0-750 DC Milliamps
0-300 DC V. 125 Ω/v
0-300 DC V. 1000 Ω/v

MODEL 336
0-500 AC Milliamps
0-25 AC Amperes
0-15 AC Volts
0-100 AC Volts

MODEL 421
0-5 DC Milliamps
0-10 DC Milliamps
0-25 DC Milliamps
0-250 DC Milliamps
0-1.5 DC Amperes
0-3 DC V 125 Ω/v
0-5 DC V. 125 Ω/v
0-8 DC V. 125 Ω/v
0-300 DC V. 125 Ω/v
0-1000 DC V. 1000 Ω/v

MODEL 431
0-250 AC Milliamps
0-1 AC Amperes
0-5 AC Amperes
0-15 AC Volts
0-75 AC Volts
0-500 AC Volts
0-750 AC Volts
0-1000 AC Volts



MODELS 426 & 436
Body Dia. 3-1/8" - Flange 4-1/4" x 4"

MODEL 426
0-5 DC Milliamps
0-25 DC Milliamps
0-50 DC Millivolts
0-150 DC Millivolts
0-6 DC V. 125 Ω/v
0-150 DC V. 125 Ω/v
0-150 DC V. 1000 Ω/v

MODEL 436
0-500 AC Milliamps
0-5 AC Amperes
0-300 AC Volts

MODELS 227-A & 237-A
Body Dia 2-5/32" - Flange 2-3/8" x 2-3/8"

MODELS 327-A & 337-A
Body Dia. 2-3/4" - Flange 3" x 3"

MODEL 227-A
0-15 DC Milliamps
0-50 DC Milliamps
0-75 DC Milliamps
0-1000 DC Milliamps
0-25 DC Millivolts
0-1 DC V. 125 Ω/v
0-3 DC V. 125 Ω/v
0-10 DC V. 125 Ω/v
0-500 DC V. 125 Ω/v
0-5 DC V. 1000 Ω/v
0-500 DC V. 1000 Ω/v
0-750 DC V. 1000 Ω/v

MODEL 237-A
0-15 AC Milliamps
0-25 AC Amperes
0-15 AC Volts
0-25 AC Volts

MODEL 327-A
0-75 DC Milliamps
0-100 DC Milliamps
0-200 DC Milliamps
0-750 DC Milliamps
0-15 DC Amperes
0-10 DC V. 125 Ω/v
0-150 DC V. 125 Ω/v
0-150 DC V. 1000 Ω/v

MODEL 337-A
0-25 AC Milliamps
0-100 AC Milliamps
0-150 AC Milliamps
0-0.5 AC Amperes
0-25 AC Amperes
0-50 AC Amperes
0-50 AC Volts
0-100 AC Volts
0-300 AC Volts
0-750 AC Volts

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and says uses one-gong identification, also occasional piano interval signal between programs, but *not* the old Nazi interval signal; announces as "Mitteldeutscher Rundfunk." Jack Salmons reports is heard in Belgium as early as 10:20 a.m.

Many monitors in Britain and in the Continent report good reception these days from 6.170, 6.100, and 7.290 transmitters at Munich, used to relay the "Voice of the United States of America," 11 a.m.-4:30 p.m. Announces, "This is Munich relaying the Voice of the United States of America in the 48, 49, and 41 meter bands." *English* news is read at 12 noon. (These Munich stations are also heard well in various parts of the United States.) Power is listed by overseas sources as around 85 kw.

The British Forces Network station at Hamburg, which had been using 7.290, now seems to be off that frequency, at least during the time the American stations at Munich are scheduled. (Harrison)

"Beliner Rundfunk," 6.071.5, is heard around 6 p.m. in Belgium; has piano interval signal; announcements in German are by a woman. (Salmon)

Gold Coast—ZOY, 4.91, Accra, is heard in England at 1:10 p.m. with news in *English*. (ISWC)

Greece—Athens has these channels available: SVR, 13.670; SVM, 9.935; SVD, 6.885; SVD2, 7.295; and SVC, 4.945. SDV2, 7.295, is scheduled daily around 2:55-3:50 p.m.; others are used principally for special relays. (Harrison) SVM, 9.935, is being heard often these days around 7:15 p.m. with pickups for American networks. (Ferguson)

Guatemala—TGWA, 9.760, is heard late afternoons and evenings with good signals. Verifies promptly. (Flinn) The 15.170 frequency is heard with fine level afternoons here in the East.

Holland—The Overseas Service of *Radio Nederland* has inaugurated a daily *except* Sunday news and commentary service ("News on the Netherlands"), heard to North America at 11 p.m. over PCJ, 9.590; 11.730 and 6.020 are announced in parallel to Europe, and it is probable that the 16-meter frequency (17.775) will be used also on occasions. For the Pacific Area, this newscast is reported to be radiated at 4:30 a.m. over 17.775, 11.730, 6.020 (and possibly over 15.220).

Better signals are being heard these evenings in North America from PCJ, 9.590, during the *Happy Station Programs*, now scheduled 9:30-11 p.m. Sundays and Wednesdays. Eddie Startz, who produces and presents the series, has announced that PCJ is now "beamed directly *into* North America." Listeners in the United States had been experiencing much QRM from Latin American stations in the vicinity of 9.590, but late reports indicate much improvement in signals from PCJ on this channel. The 11.73 and 6.02 frequencies parallel in the *Happy Station Programs*. Mr. Startz would appreciate reports from *all* parts of the U.S. on reception of the 9.590 outlet; ad-

dress, Postbus 150, Hilversum, Holland (Netherlands).

Hong Kong—ZBW3 appears to be back on 9.525 these days, but is usually buried under Perth's VLW7, 9.52. Is scheduled with *English* news at 12 midnight, and relays the BBC news at 6, 8 a.m. Has very poor signal on West Coast, according to Paul Dilg. Announces, "This is Hong Kong Calling."

India—Delhi, 15.19, usually has a good signal here in the East during the reading of *English* news at 9:30 p.m.; some evenings, 9.67, in parallel, is also good level. (Riggle)

At 10:15 p.m., Delhi announces frequencies of 21.51, 17.83, 15.39, 15.19, 15.16, and 11.87; only 15.19 is audible on West Coast at that time. (Balbi)

AIR's schedules are normally read daily at 9 a.m., heard best on 9.590. (Sellstrom)

VUC2, 6.010, Calcutta, is heard in New Zealand at 7:40 a.m. with local news in *English*. Is scheduled to relay Delhi's *English* news at 7:30 a.m.

Iran—Radio Teheran, 6.155 and 15.100, sends fair signals to Britain around 5:30-7:30 a.m.; *English* news is at 6:15 or 6:30 a.m. (Harris, England) Full schedule seems to be 1 a.m.-5:30 p.m. *English* news is heard at 9:45 a.m. (Logan, England)

Iraq—The ISWC, London, reports Baghdad has been heard in England around 2 p.m. with native music on a frequency of about 6.78.

Italy—"The Italian Broadcasting System" has been heard with strong signals on 9.63 with *English* program, 6:10-7:20 p.m.; announced 11.81 in parallel; news at 7 p.m.

This period is also heard in Sweden. (Sellstrom)

Continues to present *English* news daily at 1:50 p.m., usually has good signal on either frequency here in West Virginia.

Japan—Widely heard from Tokyo is the AFRS relay station operating to 9 a.m. sign-off on 9.605; usually best around 4 a.m. in *English* news period.

JLR, 6.015, Tokyo, relaying AFRS, is heard in Sweden to 9 a.m. closedown; announces now as "The Voice of Information and Education." (Sellstrom)

JLT3, 15.225, is being heard in Sweden again with all-Japanese programs, around 1:45-2:15 a.m. (Sonnegard)

Java—Reports to Indonesian transmitters are still being returned by Dutch authorities at Batavia marked "No Postal Communication." (Cushen)

Best signal from Java these days is heard from PLP, 11.000; in East is best around 7 a.m. with *English* news.

Is best on West Coast around 11 a.m. with *English* news. (Balbi) Heard in Nova Scotia at 9 a.m. with *English* news (Adey)

The Indonesian station on 10.060 has a very irregular schedule; appears to sign off usually around 11 a.m. with Ted Lewis' "Good Night Song," and Dutch National Anthem. (Dilg)

Kenya—VQ7LO, 4.950, Nairobi, is heard in Ireland with bad CWQRM; has news in *English* at 1 p.m. (Levi)

Korea—JODK, 2.510, Seoul, is heard

in New Zealand through heavy static around 5:56 a.m. (Whitty)

Lebanon—FXE, 8.020 (listed by some sources as 8.036), Beirut, announcing as "Ici Radio Levant," has been heard recently in West Virginia around 12:15-12:35 a.m. fadeout; had music; bad CWQRM noted. (McLaughlin)

The ISWC, London, reports is heard in Britain on 5.08 and 8.02 from 8:02 a.m. to 4:05 p.m., and has *English* news at 10 a.m. and 1:30 p.m.

In a verification just received from FXE by John Kernan, Massachusetts, frequencies were listed as 8.036 and 730 kcs. (medium-wave), with a schedule of 12 midnight-1:15 a.m., 5:15-8 a.m., and 10:30 a.m.-4 p.m. *Station asked for further reports.*

Luxembourg—Radio Luxembourg, 6.092, is heard in East to around 5 p.m. sign-off; runs to 6 p.m. Sundays; usually has good signal in North Carolina. (Ferguson)

Macao—From Australasia, it is reported that *Radio Macao,* formerly on about 7.520, has lately been heard on 9.254, around 6-9:20 a.m. sign-off, with news in Portuguese at 7:30 a.m., and news in *English* at about 7:50 a.m. Was heard for a few days in the United States; is bad spot due to CWQRM. Call is CR8AA.

Madagascar—Radio Tananarive is reported heard in Sweden on 6.065 between 10 a.m. and 1 p.m. (Malmgren)

Malaya—Radio Malaya's "Purple Network" includes frequencies of 15.300, 15.275, 11.735, and 6.770, all used in parallel, scheduled from about 3:45 to around 9:30 a.m. *English* news is read at 4:15 and 6:45 a.m. and at other times irregularly. (Harris, England)

During the past several months, these transmitters have been rarely audible in the United States.

However, the 6.770 frequency is being heard on the West Coast to around 10:15 to 10:30 a.m. sign-off (varies); relays *Radio Newsreel* from the BBC at 10 a.m. (Balbi, Dilg) This frequency should be heard in the East rather well soon, as such was the case last spring.

Monaco—Radio Monte Carlo, which normally uses 6.130, has been heard in Sweden testing around 4:30 p.m. on 6.340. (Malmgren) May be preparatory to inaugurating expanded services, including power increase, as was promised some time ago.

Morocco—A verification from CNR3, 9.083, *Radio Maroc,* Rabat, gives schedule as 1 a.m.-4:45 p.m., with news in French at 1, 2:15, 7:30 a.m., and 3, 4:30 p.m.; power is listed at 25 kw. (Cushen)

Mozambique—CR7BJ, 9.650, Lourenco Marques, still announcing as on 9.71, is now heard with "our last *English* news bulletin of the day" around 2:55 p.m.; usually leaves the air between 3:15-3:30 p.m., depending on number of messages being sent to friends in Portugal (this being concluding feature of day's activities). (Beck) I've noted that at the end of

the *English* news, it is announced that the station will return to the air at 7 a.m. South African time, or 12 midnight EST.

Is heard on West Coast signing on at 12 midnight with kukuabird and chimes; announces in native and in *English;* gives time as 7 a.m. South African time; is in Portuguese at 12:15 a.m., and signs off at 1 a.m. (Balbi) Is also heard in New York on this transmission. (Beck)

New Caledonia—New Zealanders list current schedule of *Radio Noumea,* 6.208, as 2-5 a.m., all in French; woman announcer; French news at 4 a.m.; has bad CWQRM. (Whitty)

A later report by *Radio Australia* indicates a change of frequency to 6.160.

Philippines—Paul Dilg, California, has received a letter from the Philippine Broadcasting Corporation which operates KZPI, Manila. It reads, in part: "We have received your letter of December 14, reporting reception of KZPI broadcasts in the 31-meter band on 9.710. Yours was the first report of reception we received from the States, and naturally we were very pleased to receive it. Our short-wave just went on the air in December . . ." The letter was signed by Henry L. Miller, Production Manager. Schedule sent along listed KZPI on the air 5:30 a.m.-12 midnight Philippine time (4:30 p.m.-11 a.m. EST), except on Saturdays when they also run from 12 midnight to 5:30 a.m. Philippine time (11 a.m.-4:30 p.m. EST). This extended feature is called "Pacific Jamboree."

Poland—Reception of *Polskie Radio,* 6.114 (listed, but Eastern U. S. listeners give actual frequency as around 6.100), is erratic these days; *English* news is scheduled for 3:50 p.m.

Portugal—CS2WI, Parade, is being heard afternoons around 2:30-6:30 p.m. sign-off on its new frequency of 12.865 (was formerly on 12.400); announces in both Portuguese and Spanish. (Norris) Is widely heard in various sections of the U. S. Erik Kalderen reports is also heard in Sweden.

Siam—HS8PD, listed as 6.040 (may be lower, about 5.95), Bangkok, is scheduled now 7-9:15 a.m. daily; is heard in Britain between 8:15-9:05 a.m., fades badly, is R6 on peaks. (Atkins)

South Africa—Cape Town, about 5.885, is being heard in England from around noon to sign-off at 4:10 p.m.; clock strikes 11 p.m. at 3 p.m.; most announcements are in *English,* and a relay of BBC news is featured at 3:45 p.m. (Watkinson) Is heard around 3:30 p.m. to sign-off in Eastern U.S.

Spain—A new Madrid transmitter reported is "Radio Nacional de Espana," 15.625, heard in Sweden with tests between 9:20-10:15 a.m. (Jansson)

Sweden—SDB-2, 10.780, Stockholm, is being widely heard now in the 8-9 p.m. daily "overseas" transmission; some nights has bad CWQRM but generally is good volume. SBU, 9.535, is announced as in parallel, and one monitor says a 19-m. frequency has also been mentioned. *English* news is

read around 8:05 p.m. In the daily North American transmission, 10-10:55 a.m., SBT, 15.155, usually is "sandwiched" between powerful U.S. stations, but is readable at times; SDB-2 is reported to parallel.

SDB-2 has been heard recently signing off at 6:04 p.m., with announcement in *English*, and asking for reception reports. (Ferguson)

Switzerland—For its North American evening transmission, SBC now uses HER4, 9.535; HED6, 9.655; and HER3, 6.165; runs 8:30-10 p.m., daily *except* Saturday; HER4 sends best signal.

HER4, 9.535, has recently been heard in Nova Scotia with *English* news at 5:15 p.m. (Adey)

Berne's Pacific transmission is now heard on Tuesdays and Saturdays, 2-3:30 a.m., on HE15, 11.715, and HER5, 11.865. (Beck)

Tahiti—Your ISW editor would like to pass along this tip to Eastern U.S. DXers who may have tried vainly for F08AA, 6.980, Papeete. After many *years* of trials, he has at last picked up this elusive station on various occasions this winter. Schedule now appears to be from around 10 to about 11:25 p.m. (formerly ran to 11:45 p.m.) on Tuesdays and Fridays *only*. Usually can be pulled out of the CW "hash" around 11 p.m.; at that time, a man usually "orates" in a Polynesian dialect (probably Tahitian); sounds as though he were speaking in a large, empty hall. This "oration," which some nights does not begin until around 11:15 p.m. (in which case the station still runs to about 11:45 p.m.), is followed by a little music; they do *not* use "La Marseillaise" as a signature. (Your ISW editor would appreciate a recent address for F08AA, as mail sent to the station has been returned recently marked "Unknown") Is heard on West Coast. (Dilg)

Turkey—Radio Ankara, TAP, 9.465, has been coming through better lately in the Eastern U.S. where CWQRM has abated somewhat. On the Postbag Program, 4:30-4:45 p.m. Sundays, asks for reception reports to Radio Ankara, Turkish Press Department, Ankara, Turkey.

Recently announced will increase power to 100 kw. when a new transmitter is completed, and will expand services generally.

U.S.S.R.—Our monitor in Nova Scotia, Al Adey, flashes us these Moscow schedules to North America (in *English*):

Between 7-7:45 a.m., 11.63, 11.72, 15.18, 17.82; 7:45-8:15, a.m., 7.36, 9.57, 11.63, 11.72, 11.89, 15.18, 17.82; 6.20-7.30 p.m., 6.02, 7.24, 9.48; 7:30-9 p.m., 6.02, 7.24, 9.48, 7.36, 11.89, 15.27.

In addition, Moscow is usually carried between 6:20-7:30 p.m. by Komsomolsk, 15.23. It is reported that the 8 a.m. news is also carried by a 49-meter band transmitter, probably on about 6.114.

English news in the North American beams is scheduled for 7, 8 a.m., 6:25, 7:30, 8:30 p.m.; Moscow News-

reel is scheduled for 7:45 a.m., 7 and 8 p.m.

Moscow on 9.54 has been heard carrying an *all-English* program to 6:30 a.m. (Arthur) This station has been heard at various times in California; frequency appears to be about 9.545; sometimes uses Chinese. (Dilg)

Moscow, 15.44, is strong between 10-11 p.m. on West Coast; 11.89 and 11.87 are in parallel, but with only fair signals. (Balbi)

English news and commentary is heard on 6.020 beginning at 5 p.m.; leaves the air around 5:30 p.m.; good signal in Eastern U.S. (Ferguson) This may be Kiev relaying Moscow.

United States—NAVE, aboard the *"Mount Olympus"* of the Naval Antarctic Expedition, has recently been using mostly 19.090 and about 17.840 for contacts with the United States, around 6:30 p.m. (2330 GMT). The transmitter announcing as the *"Philippine Sea"* (or merely *"Phil Sea"*) uses 17.840; has not been reported as heard recently. Reception of NAVE has been poor of late. (Arthur, McLaughlin)

WCR-5, 18.980, is the most frequently used contact station; others include WBU, 21.260.

NAVE is sometimes heard around 8:10 a.m. (1310 GMT) (Sutton)

Vatican—HVJ, 6.190, has a nice signal in England at 3:30 p.m., using Italian. (Watkinson) On this frequency, HVJ announces it also broadcasts in Spanish, French, and *English*. (Jansson)

The 9.66 channel is heard with good level in Maine at 1:15 p.m. with *English news*. (Beach)

* * *

Last Minute Tips

Laurels go to Paul Dilg, Monrovia, California, for this tip:

Ushuaia, Territory of Tierra del Fuego, Argentina, southernmost city in the world, is broadcasting irregularly on about 14.850. Usually comes on the air between 6:45 and 6:50 p.m. with music; this is very brief, about one minute; then has news in Spanish for about three minutes; finally, there is about a minute more of music, and the station leaves the air. On West Coast signal is fairly good in level, but has poor quality; at times there is CWQRM. Some nights appears to have a longer schedule. Reception here in West Virginia is about the same as on West Coast. *This one is worth trying for! If anyone has further details, please send them to me at 948 Stewartstown Road, Morgantown, West Virginia, U.S.A.*

Arthur Cushen, New Zealand, reports that *Radio Malaya* is now operated by the British Far-Eastern Broadcasting Service, Thompson Road Studios, P.O. Box 434, Singapore, Malaya. Lists schedule as:

Purple Network—15 300, 15.275, 11.735, 6.770, 3:45-9:35 a.m., but that between 5-5:30 a.m., 7:15-7:30 a.m., and 7:45-8:10 a.m., the 11.735 and 6.770 outlets carry programs from the Orange Network. (The 6.770 fre-

quency, however, is heard too as late as 10:15 to 10:30 a.m. on West Coast, according to Balbi and Dilg.)

At various times I have had vague reports about a station ZBH, operating either at Port Stanley, Falkland Islands, or in the island of South Georgia, and using a frequency around 8 megacycles. Reports indicate this station operates very irregularly, and may relay the BBC news at 6 a.m. *Does anyone have further information on this one?*

Latest schedules *announced* for Leopoldville, Belgian Congo, and probably now in effect are: To British Empire, 10:30-12 noon, 17.770; to Great Britain, 3:30-4:45 p.m., 9.745; and to America, 9-11 p.m., 9.745. (Atkins)

The Chinese station on 9.625 is XGNC, located at Kalgan, Mongolia (?); is heard in England between 8:50 and 9:15 a.m., and carries *English* news at 9 a.m. (probably relay from XGOY, Chungking); has slight interference and fade, usually heard R5; slogan is "New China Broadcasting Station." (Logan)

Time of SABC news has been changed from 12:30 p.m. to 12 noon by stations of the South African Broadcasting Corporation; this also applies to the relay by ZNB, 5.90, Mafeking, Bechuanaland. (Laubscher)

Press reports from Manila indicate that construction is under way on an elaborate, high-powered radio transmitting center designed to make American broadcasts audible to virtually the entire Eastern Hemisphere. It is reported that the station is at Malolos, in Bulacan province, 25 miles northwest of Manila, and that it has been under construction for more than a year. Manila dispatches say that while no official word has been released concerning the purpose of the station, it is reliably understood to be an ultramodern, superpower installation capable of beaming three programs simultaneously to any part of the world. The dispatches say that tentative plans call for the use of one or more frequencies by the Philippines Government for domestic broadcasts during daylight hours and that at night, when long-range transmission conditions are more favorable, programs from the United States will be beamed to Siberia, China, and the countries of Southeast Asia, including India. (Callahan)

I have had several reports from abroad lately that an American station in Rome is being heard too around 1:30 p.m. on 6.073.

A report just received from Ernest Suffolk, DX editor for *"Radio Australia"* indicates that Soerabaya, Java, uses 15.490 and 12.195 to sign-off at 10:10 a.m. Announces, "Hier ist Radio Omroep Soerabaya." Tests were also noted on 16.680 but this one is no longer heard. Mr. Suffolk lists current schedule of ZBW3, 9.525, Hong Kong, as 11:30 p.m.-1 a.m., 5:30-10 a.m.; *English* programs run 11:30 p.m.-12:15 a.m., 5:30-6:30 a.m., and 8-10 a.m., with *English* news at 12 mid-

night, and BBC news relays at 6 and 8 a.m.

Just received is this official information regarding s.w. transmitters now operating in Austria:

Vorarlberg ("Transmitter Group West") to Austria—French-controlled. Innsbruck, 6.005 (varies), signs on at 12 midnight daily, at 1 a.m. on Sundays; runs to 6 p.m. There are short breaks some days. German is the principal language used, although there are some features in French.

Group "Red-White-Red" to Austria —U.S.A.-controlled. Location of transmitter is not known but may be Salzburg. On 9.575 (varies), signs on daily at 11:57 p.m., Sundays at 1 a.m.; runs to 6 p.m. Has short breaks some days, but normally runs straight through to 6 p.m. on Saturdays and Sundays. German used throughout.

Austrian Home Service (Ravag)—In U.S.S.R. Zone. Vienna I—12.212 (varies) and 6.200 (varies). All programs are in German. Daily sign-on is 11:45 p.m., Sundays at 11:55 p.m. Sign-off on Saturdays and Sundays is 6:05 p.m.; sign-off is 7 p.m. on Mon., Tues., Wed., Thurs. Musical programs are occasionally relayed from other Austrian stations, or from the Swiss Home Service. Vienna II—Carries auxiliary programs, also all in German. Frequencies are 7.152 (varies, announced as 7.161) and 9.912 (varies, announced as 9.833). Daily sign-on is at 11 a.m.; runs to 4:30 p.m., except that on Tuesdays has additional hour of music to 5:30 p.m. closedown. Relays Vienna I a great deal; and musical programs are occasionally relayed from other Austrian stations, or from the Swiss Home Service.

* * *

Acknowledgments

Thanks go to each one who contributed in any way to ISW this month. For location of monitors mentioned herein, it is suggested the reader refer to previous issues of RADIO NEWS. —30—

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RADIO-PHONOGRAPH

Air King Products Co., Inc., has announced their latest model, "Court Jester," a table model radio-phonograph combination.

The "Court Jester" is housed in a compact hand-rubbed walnut case of

modern design. This superheterodyne receiver features a precision die-cut antenna, and a stepped-up power stage for increased volume. All controls are conveniently located.

The "Court Jester" will play 10 or 12-inch records and comes equipped with the Fidelatone lifetime needle.

Additional information on this radio-phonograph combination may be secured from *Air King Products Co., Inc.,* 1523-29 63rd St., Brooklyn, New York.

COMPACT TELEVISION SET

Producers of nearly 3000 sets in 1946, *Viewtone Television & Radio Corp.* has now announced the availability of the "Futura," their 1947 table model television set.

This model incorporates many new technical improvements developed by *Viewtone.* The "Futura" is compactly

enclosed in a cabinet of mahogany and veneer with a hand-rubbed finish and is constructed to fit conveniently in any home, office or club.

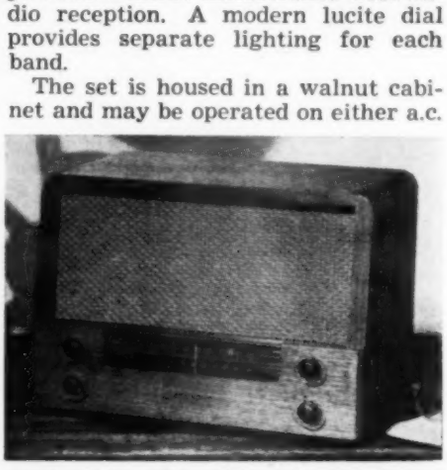
Additional information on the "Futura" can be obtained from *Viewtone Television & Radio Corp.,* 81 Willoughby St., Brooklyn, 1, New York.

AM-FM TABLE RADIO

Pilot Radio Corporation has announced the release of their new AM-FM table receiver, the Model T-521.

The new model's superheterodyne receiver has a tuning range from 535 to 1620 kc. on the standard broadcast band, and 88 to 108 mc. on the FM band. The set features seven tubes plus rectifier and germanium crystal. A loop antenna is provided for the broadcast band and a built-in antenna for FM. An outlet plus a phonograph selector position on the band switch makes future phonograph attachment possible without interference with radio reception. A modern lucite dial provides separate lighting for each band.

The set is housed in a walnut cabinet and may be operated on either a.c.



or d.c. An extra FM antenna is provided for external use where FM reception is difficult with built-in antenna only.

Pilot Radio Corporation, 37-06 Thirty-Sixth St., Long Island City, New York, will furnish additional details upon request.

CHEST-RADIO COMBINATION

Stromberg-Carlson Company has added a new member to their 1121 series of radio-phonographs. The new model, "Salem Chest," is a carryover of their unique 1938 model which has been included in the company's post-war line.

Equipped to receive standard broadcast, short-wave and signals on both FM bands, the unit provides generous album space and is engineered for future attachment of the *Stromberg-Carlson* wire recorder.

It has eight station pushbuttons which may be used on either AM or FM, tone and volume control, edge-

lighted slide rule dial, built-in antennas, automatic record changer and a 12-inch electro-dynamic full floating speaker. The set is housed in a mahogany veneer cabinet of colonial design.

Stromberg-Carlson Company, Rochester 3, New York, will provide additional information on this unit upon request.

PORTABLE COMBINATION

Audar, Inc. of Argos, Indiana has recently announced its first postwar portable radio-phonograph which is currently available for distribution.

The combination, the Model PR-6, plays ten and twelve inch records and is equipped with a crystal pickup. The portable case is covered with brown leatherette with cream trim.

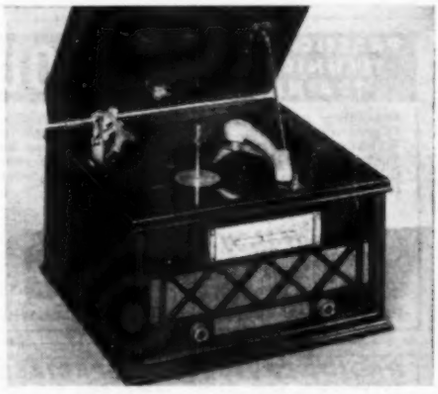
The radio receiver covers the broadcast band from 550 to 1600 kc. Receiver sensitivity is such that it makes it suitable for the reproducing of records as well as radio music and speech.

Audar, Inc. of Argos, Indiana will supply additional details on this unit to those requesting them.

RADIO-PHONOGRAPH

Among the new receivers introduced recently by *Warwick Manufacturing Corporation* is their *Clarion* "The Symphonette."

This radio-phonograph combination features two innovations in circuit design, the "Clari-therm" regulator which eliminates the initial current surge characteristic of usual a.c.-d.c. circuits and the "Clari-Disc" rectifier which provides full tonal range.



The radio covers the frequency range from 540 to 1712 kc. The phonograph features an automatic record changer which will handle 12 ten inch

or 10 twelve inch records. A self-starting, constant-speed motor has been incorporated to provide high fidelity reproduction of recordings.

The entire unit is housed in a cabinet of two-toned woods.

Additional details on the *Clarion* "The Symphonette" will be furnished by *Warwick Manufacturing Corporation* 4640 West Harrison Street, Chicago, Illinois.

HOFFMAN PORTABLE

Hoffman Radio Corporation has announced the release of their new model A-700 portable radio.

One of the features of the set is the Antenna Dor that operates normally

in closed position but when open increases signal strength eight times. The set, housed in a lightweight aluminum case with carrying handle and recessed control knobs, operates on either a.c. or d.c. or batteries.

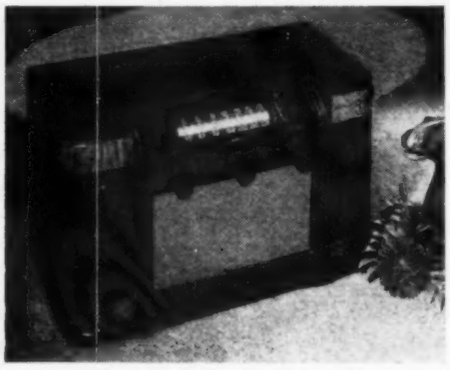
The manufacturer is *Hoffman Radio Corporation* of Los Angeles, California.

FIVE TUBE BATTERY RADIO

First shipments to dealers in rural areas have been made on the new *Westinghouse* receiver, the "Ruralist," a compact five-tube battery radio.

Designed for use where no electric current is available, the table-size walnut cabinet compactly houses the chassis, battery packs and wiring units. A special phosphorescent slide-rule dial makes tuning possible in poor light or total darkness.

The "Ruralist" is equipped with the



exclusive "Plenti-Power" circuit and a.v.c. to tone down the high power of nearby stations and bring up distant stations so that relatively even reception is possible.

Acoustically balanced with the chas-

sis and cabinet, the six-inch permanent magnetic speaker assures clear tone reproduction. The model is equipped with five-foot leads for use with an external antenna and ground.

Westinghouse Electric Corporation, Pittsburgh, Pennsylvania, is the manufacturer.

PORTABLE COMBINATION

A new portable automatic radio-phonograph, known as the "Holiday," has been recently introduced to the

trade by *Electronic Corporation of America.*

The use of a selenium rectifier results in less heat being generated within the cabinet and provides increased sensitivity and power output, according to the manufacturer. This model will deliver 1.7 watts of undistorted power output.

This combination is functional in design and has been weather-sealed for complete protection.

Additional details of the "Holiday" will be furnished upon request to *Electronic Corporation of America,* 170 53 St., Brooklyn, New York.

KITCHEN RADIO

Faraday Radio Mfg. Co. is currently marketing a novelty kitchen radio, known as the 1947 "Refrigeradio."

This unique receiver is designed to simulate a modern refrigerator in appearance and is housed in a wooden cabinet with a special plywood door. The cabinet is painted with a white washable finish.

The receiver is a six tube, a.c.-d.c. operated superheterodyne which features a Franklin directional built-in antenna. The speaker is of Alnico V alloy and a beam power pentode audio system is used.

The tuning dial is lettered in white on the black dial for easy tuning. The entire tuning control mechanism is concealed by the front door on the "Refrigeradio" when the unit is not being used or is tuned to the desired station. The speaker grille simulates the grilles usually found on all refrigerators.

Full details and prices on this kitchen radio will be furnished upon request. Write direct to the company, *Faraday Radio Mfg. Co.,* Box 259, Church Street Annex, New York 8, New York.

HOME RECEIVER

One of the latest additions to *Air King's* 1947 home radio line is "The Regent," a 6-tube a.c.-d.c. superheterodyne which is available in either ivory or walnut plastic cabinets.

The unit features precision, die-cut antenna for maximum signal; modern illuminated, white-on-black airplane

tuning dial; Alnico V speaker; and a beam power pentode audio system.

Full details on "The Regent" and other receivers in the line will be furnished upon request to *Air King Products Co., Inc.,* 1523-29 63rd Street, Brooklyn, New York.

—30—

Miniature Tube Receiver

(Continued from page 49)

as a superheterodyne. The tube line-up will be somewhat different. In this case, we might use a 6BD6 or 9003 r.f. stage, a 6BA6 mixer oscillator, a 6BD6 or 9003 i.f. amplifier, a 6AQ6 diode detector, a.v.c. rectifier and first audio amplifier, 6AU6 triode connected phase inverter and 6AQ5 push-pull output. The circuit diagram will be determined by the coils that are used. The circuit from the detector to the speaker will remain the same.

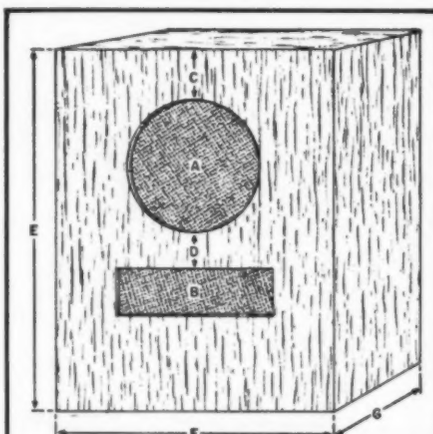
The coils and i.f. transformers may be purchased in the small sizes used in miniature receivers. The oscillator coil is mounted beneath the chassis. This will produce a highly sensitive and selective receiver with high power output.

Whichever receiver is built, you will find that for the purpose it is intended, it will prove equal or superior to an equivalent receiver using the larger tubes. The smaller tubes are easy to work with and will be found to yield equipment which is small, light, and efficient. This is particularly important in cases where light, portable equipment is desired.

For instance, if a small ten watt amplifier is desired, the amplifier section may be lifted from the receiver diagram and may be built on an even smaller chassis, measuring approximately 6 by 5 by 1½ inches. Another miniature tube may be used. The 6J6, a dual triode, makes an excellent mixer and a 6AU6 can be used as a pentode microphone amplifier. The circuit now becomes that of Fig. 2.

We now have a small efficient portable 10 watt amplifier which features two inputs, one microphone, and one phono. This amplifier could be supplied readily from a storage battery by

Fig. 4. Mechanical details for constructing a bass-reflex type cabinet. All measurements are outside dimensions, assuming ¾" plywood is used.



Dimension	8"	12"	15"
A	7"	11"	14"
B	All to be ½ the area of A		
C	3"	4"	4"
D	2½"	3"	3½"
E	24"	30"	33"
F	17"	23"	25"
G	11"	13"	14"

substituting a *Vibrapack* for the power supply, which gives us a portable amplifier for mobile use which might also include use as a 10 watt modulator for a ham transmitter. You will find, as you use more and more of these little giant tubes, their real worth will pay off in greater efficiency and smaller size. -30-

For the Experimenter
(*Continued from page* 67)

and one 1000 ohm, 10 w. resistor. No filter choke is needed as adequate filtering is obtained with the two condensers and resistor, R_1, shown in the diagram.

A 5" x 7" baseboard of plywood, similar to that employed for the receiver, is used to mount all parts by means of small wood screws and terminal strips.

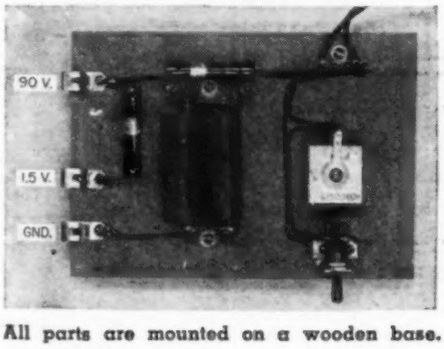
In hooking up this power supply to the receiver be sure that proper connections are made. The 90 volt terminal should go to "B+," the 1.5 volt terminal should go to "B—,A+," while the ground lead should be connected to the "A—" terminal of the receiver.

In adapting this power supply for use with the neon tube oscillator, all that is necessary is to connect a piece of wire across X-X shown on the diagram and be sure that proper connections are made to the oscillator. The 90 volt terminal should go to "+90" volts and the ground terminal should go to "—90" volts of the oscillator.

Should you desire to build this supply as an additional piece of equipment for use in operating other units, it would be advisable to substitute a 25,000 ohm, 2 watt resistor, for R_2.

Under this condition it is possible to obtain an output voltage of approximately 90 volts at a total current drain of 100 ma.

If this power supply is to be used with equipment having a metal chassis or panel, care should be taken so



All parts are mounted on a wooden base.

that the line plug is inserted with the proper polarity. The full line voltage will appear between the chassis and ground if the plug is reversed. The correct polarity may easily be determined by connecting a 115 volt light between the negative of the power supply and a physical ground, such as the radiator or water pipe. If the light lights, the plug on the power supply should be reversed.

-30-

Technical BOOKS

"FUNDAMENTALS OF INDUSTRIAL ELECTRONIC CIRCUITS" by Walther Richter. Published by *McGraw-Hill Book Company, Inc.,* New York. 556 pages. Price $4.50.

This book should prove to be of great value to the radio serviceman who wishes to expand his operation to include the servicing of industrial electronic equipment.

Originally designed as text material for an evening course in industrial electronics given by the University of Wisconsin's Extension Division, the author has presented his subject without resorting to the use of differential or integral calculus.

This text may easily be used by the student as a home study course in industrial electronics as each chapter carries problems and a bibliography for additional reading on the subject. The subject matter is presented in an orderly progression from basic concepts of direct current through alternating current theory, rectifiers, various tube applications, to specialized control circuits and equipment.

Careful study of the material contained in this book should provide the serviceman with a workable understanding of the intricacies of the industrial electronic equipment he is likely to encounter in his work.

* * *

"AN INTRODUCTION TO ELECTRONICS" by Ralph G. Hudson. Published by *The Macmillan Company,* New York. 94 pages. Price $3.00.

This book is designed for the enlightenment of that large segment of the population who are interested in the science of electronics but are without the technical background to understand the average electronics text.

Mr. Hudson, who is professor of electrical engineering at the Massachusetts Institute of Technology, has produced a thoroughly readable book which does not sacrifice technical accuracy in the simplification process. While the author does not talk down to his readers he has developed his subject in such a manner that a non-technical reader can enjoy and understand the text.

The book is divided into seven chapters dealing with the constitution of matter, the flow of electricity, radio communication, reproduction of sound and picture, modern sources of light, methods for increasing power, and diverse applications of electronics.

Textual material is well illustrated by line drawings and photographs both of which are used lavishly throughout the book.

* * *

"DRAFTING FOR ELECTRONICS" by L. F. B. Carini. Published by *McGraw-Hill Book Company, Inc.,* New York. 206 pages. Price $2.50.

Here at last is a complete text on the subject of drafting as applied to

the specialized field of electronics.

All of the material included in the text is based upon the approved standards as promulgated by the American Standards Association and the Institute of Radio Engineers.

The book is divided into fourteen chapters and an appendix. Subjects covered include schematic drafting, fundamentals of instrumental drawing, essentials of lettering, abbreviations and letter symbols, symmetry and balance, schematic delineation, schematic circuit projection, schematic patent drawing, industrial electronics, technical outline drawings, graphic integration, checking of drawings, preparing drawing prints and drawings for reproduction.

Full information is given on the proper use of the various drafting tools and accessories.

Presentation of the subject matter is sufficiently lucid to allow this book to be used as a home study text. The book is well illustrated with photographs and line drawings.

* * *

"RADIO-ELECTRONICS QUIZ BOOK" compiled by R. L. Duncan. Published by *Radio-Electronics Publishing Corp.,* New York. 108 pages. Price $2.00.

This unique book has been designed as a self-help text for those preparing for the various government radio examinations.

Intended as a review of radio-electronics theory and practice for radio license examination preparation, this book is not supposed to be a basic text covering various radio subjects but is to be used to supplement knowledge gained from other sources.

The text consists of 1289 "true and false" questions which are divided into five sections covering basic theory and practice, basic radio laws, radiotelephony, advanced radiotelephony, radio telegraphy, and advanced radiotelegraphy. Correct answers to the questions are given in the book and where the original statement was "false" the correct answer is included.

Those of you who are planning to take the licensing examinations in the near future should profit from a careful study of the material contained in this book.

—30—

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RCA Television Chassis and Power Supply. No tubes or harness, $90. Meissner Signal Calibrator Mod. No. 9-1006, $65. Alexander Radio & Electrical Shop, Roy Alexander, Jr., Montezuma, Iowa.

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FREQUENCY meters 221, excellent condition. 125-20,000 KCS, $45.00. Wm. Hoss, 1807 Lanham Ct., Banning Homes, San Pedro, Calif.

UHF Cavity oscillators, calibrated butterfly wavemeters, 300-1000 Mcs. $10-15. Surplus, 436 Cornelia St., Boonton, N. J.

PHOTO-Electronic-Organ. Metal parts and keys for making instrument described in June, July issues 1946, except case, lamps and power pack. For sale for $75.00 cash. G. E. Ramer, 302 N. E. 100 Street, Miami 38, Fla.

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LOWEST Prices. Radio Tubes, parts. Bargain lists 3c. Potter, 1314 McGee, Kansas City 6, Mo.

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FRESH mailing lists. Trial 1000 radio-servicemen-dealers $10.00; 600 radio, equip. mfrs. $8.00; 55 radio amplifiers mfrs. $3.00; 49 radio tube mfrs. $3.00. House of Butte, 60 E. 42nd St., New York 17, N. Y.

TELEVISION Receiver coil kits including complete set of 10 matched coils for 5 or 7" Television receiver. Instructions wrapped around each coil include typical circuit application. Kits are shipped prepaid $4.95 each. Vision Research Laboratories, P. O. Box 52, Kew Gardens 15, N. Y.

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PHONOGRAPH oscillators uses 117N7GT, each $4.25; in lots of 10, $3.95. Turner BX microphones, $7.95. A. & R. Sales & Distg. Co., 516 Barnett, Kansas City 7, Kansas.

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INVENTORS—Steps to be taken in obtaining patent protection available upon request. Victor J. Evans & Co., 248-D Merlin Bldg., Washington 6, D. C.

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3-Tube Short-Wave Receiver

(*Continued from page* 59)

The short-wave coils can be tried with the same tuning procedure. The small antenna condenser should be adjusted when switching coils. An antenna, about 75 to 100 ft. long, has

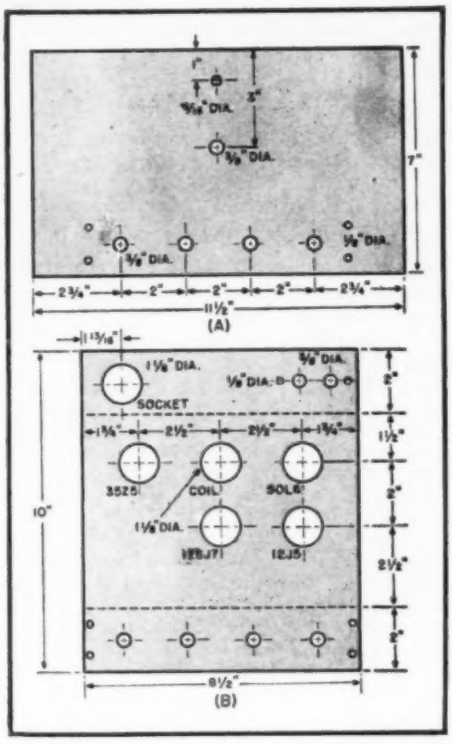

Fig. 2. Panel and chassis layout.

proven successful. This antenna should be as high as possible and in the clear. No ground was used on the receiver. If one decides to use a ground, a .01 μfd. condenser should be placed between the receiver and ground.

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ERRATA

We wish to apologize for an error made in the February, 1947 issue of RADIO NEWS. The authors of "Superregenerative Frequency Converter" appearing on page 39 were P. V. Trice, W3QHS and M. Barbat, Jr., W3KIL. We regret that Mr. Barbat's name was spelled incorrectly.

• • •

Resistor values for the voltage divider given in the circuit on page 55 of the January, 1947 issue ("Home Constructed V.T.V.M.") should be as follows: R_1—2.4 megohms; R_5—300,000 ohms; R_6—240,000 ohms; R_7—30,000 ohms and R_8—30,000 ohms. Please correct your parts list to conform with these values.

• • •

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INDEX OF ADVERTISERS April 1947

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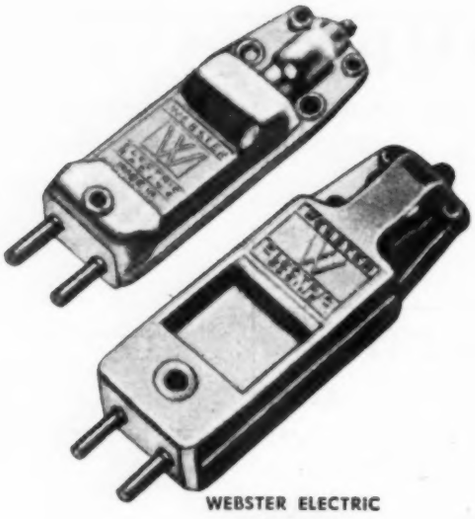

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The Webster Electric crystal cartridges are uniform producers of true tone quality. In addition to faithful reproduction, they are dependable and have long life. Their past record of performance insures their future dependable service.

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(Above) Mallory operators wind resistance wire on vitreous enamel resistors. This is a precision job. Operators chalk numbers of turns being wound by use of gauge. Resistance value of each resistor is kept within rigid tolerance specifications. Note the straight line production set up. After resistors are wound and welded, they move on to enameling and baking operations in the background.

When a resistor is made at the Mallory plant, it is wound with an accuracy of ±5%—then provided with an improved vitreous enamel that gives greater protection, keeps out moisture, minimizes warping, stretching and shifting of wire. It is subjected to tests every step of the way to make sure that "hidden corrosion" won't shorten its life.

As a result, Mallory resistors remain free from failures. They stay accurate and dependable. They deliver premium quality. Only rigid manufacturing control can give you *that.*

Yet, like other items in the Mallory line, Mallory resistors cost no more. What's more, they cover the power range from 10 watts to 200 watts with a wide variety of convenient values. And they're easy to get — from well-located distributors who are willing to give you any help you ask. What's the real meaning of "Approved Precision Products?" Just that you expect more and get more from Mallory.

See You at the Radio Parts Show in Chicago—Booth 106

P R MALLORY & CO Inc.

MALLORY

VIBRATORS . . . VIBRAPACKS* . . . CAPACITORS . . . VOLUME CONTROLS . . . SWITCHES . . . RESISTORS . . . FILTERS . . . RECTIFIERS . . . POWER SUPPLIES.

*Reg. U. S. Pat. Off.

APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

THE SYLVANIA *Lock-In* TUBE

. . . PACKS A WORLD OF SUPERIOR QUALITIES . . .

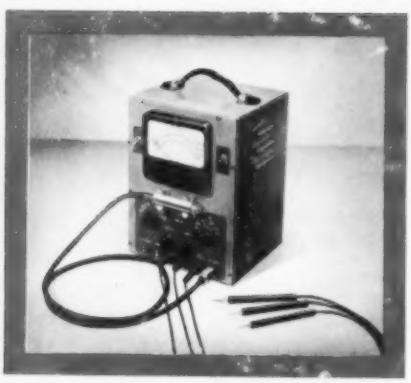
UNIVERSALLY KNOWN FOR ITS ELECTRICAL AND MECHANICAL ADVANTAGES

For your radio set – FM or television equipment – you need a tube *made* to give superior performance. You'll want the tube that's become famous because of its compactness, smallness . . . and its ability to handle ultra-high frequencies with ease!

We urge you to buy the Sylvania Lock-In Tube. It is *the* tube specifically engineered to more than satisfy the requirements of the sets of today – *and* tomorrow.

Look at these outstanding electrical and mechanical advantages:

Lock-In locating plug . . . also acts as shield between pins. Short, direct connections . . . fewer welded joints – less loss. Getter located on top . . . shorts eliminated by separation of getter material from leads. No top cap connection . . . overhead wires eliminated. Reduced overall height . . . space saving. Stays put in mobile and portable rigs.



Another product of Sylvania Research is the Poly (MULTI-PURPOSE) Meter above. Designed particularly for accurate measurement of electrical conditions in circuit components operating with power, audio and radio frequencies up to 300 mc., this new instrument permits radio and electronic servicemen to isolate quickly condensers, coils and resistors when faults occur and check circuit operation after replacements are made. This unit is the sign of a progressive establishment.

RADIO TUBE DIVISION, Emporium, Pa.

SYLVANIA ELECTRIC

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULB